ATTACHMENT 9. BIOLOGICAL OPINION

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United States Department of the Interior

FISH AND WILDLIFE SERVICE

Ecological Services
5353 Yellowstone Road, Suite 308A
Cheyenne, Wyoming 82009

DEC 29 2014

In Reply Refer To:
06E13000-2013-F-0044

Memorandum

To: Field Manager, Bureau of Land Management, Rawlins Field Office, Rawlins, Wyoming

From: Field Supervisor, U.S. Fish and Wildlife Service, Wyoming Field Office, Cheyenne, Wyoming

Subject: Final Biological Opinion for the Continental Divide-Creston Natural Gas Project, Carbon and Sweetwater Counties, Wyoming

In accordance with section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 *et seq.*), and the Interagency Cooperation Regulations (50 CFR 402), this document transmits the U.S. Fish and Wildlife Service's (Service) biological opinion based on our review of the proposed Continental Divide-Creston Natural Gas Project located in Carbon and Sweetwater Counties, Wyoming, and its effects on the endangered Colorado pikeminnow (*Ptychocheilus lucius*), humpback chub (*Gila cypha*), bonytail (*Gila elegans*), and razorback sucker (*Xyrauchen texanus*) and their designated critical habitats.

This biological opinion is in response to your October 27, 2014, request to initiate consultation for the Continental Divide-Creston Natural Gas Project (CD-C Project; Project). The Service concurs that the proposed Project may adversely affect the endangered Colorado pikeminnow (*Ptychocheilus lucius*), humpback chub (*Gila cypha*), bonytail (*Gila elegans*), and razorback sucker (*Xyrauchen texanus*) and their designated critical habitat.

Additionally, in sections 8.1 and 8.3 of the biological assessment, you requested concurrence on your determinations that the proposed Project may affect, but is not likely to adversely affect, the federally threatened Canada lynx (*Lynx canadensis*) and Ute ladies'-tresses orchid (*Spiranthes diluvialis*), respectively. Based on the information provided in your Biological Assessment we concur that the Project, as currently proposed, is not likely to adversely affect the Canada lynx because of (1) the lack of suitable habitat for the snowshoe hares, the primary prey of lynx, and (2) the implementation of conservation measures to protect riparian habitats that could serve as migration corridors for lynx dispersing from occupied habitats to the south and northwest. Based on the information provided in your Biological Assessment we concur that the Project, as currently proposed, is not likely to adversely affect the Ute ladies'-tresses orchid because of

(1) the lack of known occupied habitat (2) the limited amount of potential habitat within the action area, and (3) the commitment by the BLM to implement conservation measures to avoid adverse effects, such as spatial buffers and timing restrictions.

CONSULTATION HISTORY

On January 21-22, 1988, the Secretary of the Department of the Interior; the Governors of Wyoming, Colorado, and Utah; and the Administrator of the Western Area Power Administration signed a Cooperative Agreement to implement the "Recovery Implementation Program for Endangered Fish Species in the Upper Colorado River Basin" (USFWS 1987). In 2001, the Recovery Program was extended until September 30, 2013. The objective of the Recovery Program is to recover the listed species while water development continues in accordance with Federal and State laws and interstate compacts.

In order to further define and clarify processes outlined in sections 4.1.5, 4.1.6, and 5.3.4 of the Recovery Program, a section 7 Agreement (Agreement) and a Recovery Implementation Program Recovery Action Plan (RIPRAP) was developed (USFWS 1993). The Agreement establishes a framework for conducting all future section 7 consultations on depletion impacts related to new projects and all impacts associated with historic projects in the Upper Basin. Procedures outlined in the Agreement are used to determine if sufficient progress is being accomplished in the recovery of the endangered fishes to enable the Recovery Program to serve as a reasonable and prudent alternative (RPA) to avoid jeopardy. The RIPRAP was finalized on October 15, 1993, and has been reviewed and updated annually.

In accordance with the 1993 Agreement, the Service annually assesses progress of the implementation of recovery actions to determine if progress toward recovery has been sufficient for the Recovery Program to serve as a RPA for projects that deplete water from the Colorado River. In the last review the Service determined that the Program has made sufficient progress to offset water depletions from individual projects up to 4,500 acre-feet/year. Therefore, it is appropriate for the Recovery Program actions to serve as Conservation Measures in the project description for projects up to 4,500 acre-feet/year.

After many years of successful implementation of the Recovery Program and Agreement, Federal action agencies have come to anticipate Recovery Program activities and a requirement of a financial contribution (for new depletions greater than 100 acre-feet) toward these activities serving as RPAs that must be included in their project planning to avoid jeopardy to listed species. Thus, the RPA has essentially become part of the proposed action. The Recovery Program activities will now serve as conservation measures within the proposed action and minimize adverse effects to listed species or critical habitat. The following excerpts summarize portions of the Recovery Program that address depletion impacts, section 7 consultation, and Project proponent responsibilities:

> "All future section 7 consultations completed after approval and implementation of this program (establishment of the Implementation Committee, provision of congressional funding, and initiation of the elements) will result in a one-time contribution to be paid to the Service by water project proponents in the amount

> of $10.00 per acre-foot based on the average annual depletion of the project . . . This figure will be adjusted annually for inflation [the current figure for FY2015 is $20.54 per acre-foot] . . . Concurrently with the completion of the Federal action which initiated the consultation, e.g., . . . issuance of a 404 permit, 10 percent of the total contribution will be provided. The balance . . . will be . . . due at the time the construction commences . . . ."

It is important to note that these provisions of the Recovery Program were based on appropriate legal protection of the instream flow needs of the endangered Colorado River fishes. The Recovery Program further states:

> ". . . it is necessary to protect and manage sufficient habitat to support self-sustaining populations of these species. One way to accomplish this is to provide long term protection of the habitat by acquiring or appropriating water rights to ensure instream flows. Since this program sets in place a mechanism and a commitment to assure that the instream flows are protected under State law, the Service will consider these elements under section 7 consultation as offsetting project depletion impacts."

BIOLOGICAL OPINION

This biological opinion addresses an average annual depletion of approximately 650 acre-feet of water from the Upper Colorado River Basin. Water depletions in the Upper Basin have been recognized as a major source of impact to endangered fish species. Continued water withdrawal has restricted the ability of the Colorado River system to produce flow conditions required by various life stages of the fishes.

Critical habitat has been designated for the Colorado pikeminnow, humpback chub, bonytail, and razorback sucker within the 100-year floodplain in portions of their historic range (59 FR 13374). This biological opinion does not rely upon the regulatory definition of "destruction or adverse modification" of critical habitat at 50 CFR 402.02. Instead, we have relied upon the statutory provisions of the ESA to complete the following analysis with respect to critical habitat. In considering the biological basis for designating critical habitat, the Service focused on the primary physical and biological elements that are essential to the conservation of the species without consideration of land or water ownership or management. The Service has identified water, physical habitat, and biological environment as the primary constituent elements. This includes a quantity of water of sufficient quality that is delivered to a specific location in accordance with a hydrologic regime that is required for the particular life stage for each species. Water depletions reduce the ability of the river system to provide the required water quantity and hydrologic regime necessary for recovery of the fishes. The physical habitat includes areas of the Colorado River system that are inhabited or potentially habitable for use in spawning and feeding, as a nursery, or serve as corridors between these areas. In addition, oxbows, backwaters, and other areas in the 100-year flood plain, when inundated, provide access to spawning, nursery, feeding, and rearing habitats

DESCRIPTION OF THE PROPOSED ACTION

ACTION AREA

Our regulations define the action area as all areas directly or indirectly affected by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02). Water depletions associated with the Project will result in a loss of water from the Upper Colorado River Basin.

PROJECT DESCRIPTION

The CD-C Project involves drilling up to 8,950 natural gas wells in a Project area of about 1.1 million acres (1,672 square miles) located in Townships 14 through 24 North, Ranges 91 through 98 West, Sixth Principal Meridian, Carbon and Sweetwater Counties. The Rawlins Field Office (RFO) manages BLM surface lands and the Federal mineral estate in the Project area. The CD-C Project is an infill project in a region that has seen extensive natural gas exploration and development. More than 4,700 wells have already been drilled in the Project area, including the Continental Divide, Wamsutter, Creston/Blue Gap and Continental Divide/Wamsutter II projects. Although operations are subject to change as conditions warrant, the long-term plan of development is to drill at the average rate of approximately 600 wells per year until the resource is fully developed (about 15 years).

Wells may be drilled conventionally (vertically) or directionally from single or multiple well pads. The Project also includes construction and operation of ancillary facilities such as: roads; gas, water, and condensate-gathering pipelines; overhead and buried power lines; and separation, dehydration, metering, and fluid-storage facilities. The average life of a well is expected to be 30 to 40 years. Combining average well life with a 15-year field development period produces a potential Project life of 45 to 55 years.

Up to 25 drilling-rigs will be used at any particular time in order to achieve development objectives. Wells will be drilled using conventional, mechanically powered mobile drilling rigs. Drilling each gas well will take from 7 to 10 days, with additional time likely for directional wells and wells deeper than 10,000 feet. Completion and testing operations typically require approximately 10 to 20 (up to 30) days to perform. Drilling will occur year-round subject to environmental considerations.

Approximately 24,000 to 42,000 barrels (3.1 to 5.4 acre-feet) of water are needed to perform drilling and completion operations for each well. Fresh water will be used for drilling the first 5,000–7,000 feet of each well, and water-based muds will be used for the remainder of the drilling operation. Water will come from existing and new water-supply wells within the project area and from produced-water sources. Using produced water to the greatest extent possible will conserve fresh-water aquifers and reduce the amount of water depleted from the Colorado River system. Estimated annual freshwater use within the CD-C Project area will range from 1,856 to 3,248 acre-feet per year and will average 2,552 acre-feet per year. All freshwater will be withdrawn from groundwater sources; no freshwater will be withdrawn from surface waters.

Water needed for drilling and completion activities will come from new and existing State Engineer's Office (SEO)-approved local water wells, as well as from produced-water sources.

Most (96 percent) SEO-approved wells are completed in Tertiary age aquifers, particularly the Wasatch Formation. According to Mason and Miller (2005), the Wasatch Formation has the potential to lose groundwater to the southeast and ultimately to the Colorado River system. Roughly 20 percent of the Wasatch Formation within the CD-C project area is within that portion of the Washakie Structural Basin that loses groundwater to the southeast toward the Little Snake River, a tributary of the Colorado River. As such, an interruption of this groundwater flow could lead to depletions to the Colorado River system, although the proportion of flow in the Little Snake River that comes from groundwater discharge from the Wasatch Formation has not been quantified.

The Project's estimated annual freshwater use ranges from 1,856 to 3,248 acre-feet per year, averaging 2,552 acre-feet per year. Assuming groundwater use from the Wasatch Formation is evenly distributed across the Project area, approximately 20 percent of the groundwater will come from that portion of the Wasatch Formation that could contribute water to the Little Snake River. Therefore, between 371 and 650 acre-feet of groundwater, averaging 510 acre-feet, will be removed from the Wasatch Formation in this area each year.

The BLM has determined that all CD-C groundwater withdrawals from that portion of the Washakie Structural Basin that loses groundwater toward the Little Snake River will be considered depletions for purposes of the RIP. Furthermore, the BLM is consulting on the maximum estimated annual usage, 650 acre-feet per year, in order to address the maximum effects to listed Colorado River species and their designated critical habitat.

The CD-C draft environmental impact statement (DEIS) provides a detailed description and analysis of the Proposed Action and alternatives, including the agency preferred alternative (alternative F). Alternative F limits development to no more than eight well pads per section to minimize surface disturbance and reduce impacts to the area's resources, including federally listed and proposed species. The alternative emphasizes transportation planning, development pre-planning, and a fugitive dust control plan. Under this alternative, well pads, access roads, pipelines, and ancillary facilities located within 0.5 mile of Muddy Creek, Red Wash, and Bitter Creek and within 0.25 mile of playas in the Chain Lakes Wildlife Habitat Management Area will be subject to controlled surface use stipulations in order to address salt and sediment impacts to sensitive fish species and general water quality.

CONSERVATION MEASURES

Conservation measures are actions that the action agency and applicant agree to implement to further the recovery of the species under review. The beneficial effects of conservation measures are taken into consideration for determining both jeopardy and adverse modification analyses. As explained in the Consultation History section, the Recovery Program is intended to implement actions that are needed to recover the endangered fishes and avoid jeopardy and adverse modification of critical habitat. Included in the Recovery Program is a requirement for project proponents of projects that cause water depletions greater than 100 acre-feet per year to make monetary contributions to the Recover Program. The BLM agrees to incorporate any required contribution as a condition of any issued permit or authorization. The conservation measures for this project are below:

The Recovery Program will serve as conservation measures to minimize adverse affects to the endangered fishes and their critical habitat caused by the project's water depletions. Depletion impacts can be offset by accomplishment of activities necessary to recover the endangered fishes as specified under the RIPRAP and the water Project proponent's one-time contribution to the Recovery Program for new depletions greater than 100 acre-feet per year.

New Depletion

As the project's average annual new depletion of 650 acre-feet is below the current sufficient progress threshold of 4,500 acre-feet, the Recovery Program will serve as conservation measures to minimize adverse affects to the Colorado pikeminnow, razorback sucker, humpback chub, and bonytail and designated critical habitat caused by the project's new depletion.

With respect to the depletion contribution the applicant will make a one-time payment which has been calculated by multiplying the Project's average annual depletion (acre-feet) by the depletion charge in effect at the time payment is made. For Fiscal Year 2015 (October 1, 2014, to September 30, 2016), the depletion charge is $20.54 per acre-foot for the average annual depletion which equals a total payment of $13,351 for this Project. Ten percent of the total payment (i.e., $1,350) will be provided to the Service's designated agent, the National Fish and Wildlife Foundation (Foundation), at the time of issuance of the Federal approvals from the BLM. The balance will be due at the time the construction commences. The payment will be included by the BLM as a condition of approval. The amount payable will be adjusted annually for inflation on October 1 of each year based on the Composite Consumer Price Index. All payments should be made to the Foundation:

National Fish and Wildlife Foundation
Attn: Donna McNamara, Finance Department
1133 15th Street, NW, Suite 1100
Washington DC 20005

The payment will be accompanied by a cover letter that identifies the project and biological opinion number **(06E13000-2013-F-0044)** that requires the payment, the amount of payment enclosed, check number, and the following notation on the check – "Upper Colorado Fish Recovery Program, NA.1104." The cover letter also shall identify the name and address of the payor, the name and address of the Federal agency responsible for authorizing the Project, and the address of the Service office issuing the biological opinion. This information will be used by the Foundation to notify the BLM and the Service that payment has been received. The Foundation is to send notices of receipt to these entities within five (5) working days of its receipt of payment.

STATUS OF THE SPECIES AND CRITICAL HABITAT

The purpose of this section is to summarize the best available information regarding the current range wide status of the listed fish species. Additional information regarding listed species may be obtained from the sources of information cited for these species[1].

COLORADO PIKEMINNOW

SPECIES DESCRIPTION

The Colorado pikeminnow (*Ptychocheilus lucius*) is the largest cyprinid fish (minnow family) native to North America and evolved as the main predator in the Colorado River system. Individuals begin consuming other fish for food at an early age and rarely eat anything else (Sigler and Sigler 1996). It is a long, slender, cylindrical fish with silvery sides, greenish back, and creamy white belly (Sigler and Sigler 1996). Historically, individuals may have grown as large as 6 feet long and weighed up to 100 pounds (estimates based on skeletal remains) (Sigler and Miller 1963), but today individuals rarely exceed 3 feet or weigh more than 18 pounds (Osmundson et al. 1997).

The species is endemic to the Colorado River Basin, where it was once widespread and abundant in warm water rivers and tributaries from Wyoming, Utah, New Mexico, and Colorado downstream to Arizona, Nevada, and California (multiple citations in U.S. Fish and Wildlife Service 2002b). Currently, wild populations of pikeminnow occur only in the Upper Colorado River Basin (above Lake Powell) and the species occupies only 25 percent of its historic range-wide habitat (U.S. Fish and Wildlife Service 2002b). Colorado pikeminnow are long distance migrators, moving hundreds of miles to and from spawning areas, and requiring long sections of river with unimpeded passage. They are adapted to desert river hydrology characterized by large spring peaks of snow-melt runoff and low, relatively stable base flows.

The Office of Endangered Species first included the Colorado pikeminnow (as the Colorado squawfish) in the List of Endangered Species on March 11, 1967 (32 FR 4001). It is currently protected under the Endangered Species Act of 1973 as an endangered species throughout its range, except the Salt and Verde River drainages in Arizona. The Service finalized the latest recovery plan for the species in 2002 (U.S. Fish and Wildlife Service 2002b) but is currently drafting an updated revision.

The Service designated six reaches of the Colorado River System as critical habitat for the Colorado pikeminnow on March 21, 1994 (59 FR 13374). These reaches total 1,148 miles (mi) as measured along the center line of each reach. Designated critical habitat makes up about 29 percent of the species' historic range and occurs exclusively in the Upper Colorado River Basin. Portions of the Colorado, Gunnison, Green, Yampa, White, and San Juan Rivers are designated critical habitat. The primary constituent elements of the critical habitat are water, physical habitat, and the biological environment (59 FR 13374).

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[1] The latest recovery goals for all four endangered fish, which provide information on species background, life history, and threats, can be found on the internet at: http://www.coloradoriverrecovery.org/documents-publications/foundational-documents/recovery-goals.html

Water includes a quantity of water of sufficient quality delivered to a specific location in accordance with a hydrologic regime required for the species. The physical habitat includes areas of the Colorado River system that are inhabited or potentially habitable for use in spawning and feeding, as a nursery, or serve as corridors between these areas. This includes oxbows, backwaters, and other areas in the 100-year floodplain that provide access to spawning, nursery, feeding, and rearing habitats when inundated. The biological environment includes food supply, predation, and competition from other species.

Recovery of Colorado pikeminnow in the Colorado River Basin is considered necessary only in the Upper Colorado River Basin (above Glen Canyon Dam, including the San Juan, and Green River sub-basins) because of the present status of populations and because existing information on Colorado pikeminnow biology supports application of the metapopulation concept to extant populations (U.S. Fish and Wildlife Service 2002b). As a result, this biological opinion will focus on the status of the Colorado pikeminnow in that unit.

LIFE HISTORY

The Colorado pikeminnow requires relatively warm waters for spawning, egg incubation, and survival of young. Males become sexually mature at approximately 6 years of age, which corresponds to a length of about 400 millimeters (mm) (17 inches (in.)), and females mature one year later (Sigler and Sigler 1996).

Mature adults migrate to established spawning areas in late spring as water temperatures begin to warm, with migration events up to 745 river kilometers (km) round-trip on record (463 miles) (Bestgen et al. 2005). Spawning typically begins after peak flows have subsided and water temperatures are above 16° Celsius (°C) (60.8° Fahrenheit (°F)) (multiple references in Bestgen et al. 2005). Mature adults deposit eggs over gravel substrate through broadcast spawning and eggs generally hatch within 4 to 6 days (multiple references in Bestgen et al. 2005). River flows then carry emerging larvae fish (6.0 to 7.5 mm long (0.2 to 0.3 in.)) downstream 40 to 200 km (25 to 125 mi), to nursery backwaters, where they remain for the first year of life (U.S. Fish and Wildlife Service 2002b).

Colorado pikeminnow reach lengths of approximately 70 mm by age 1 (juveniles) (2.8 in.), 230 mm by age 3 (subadults) (9 in.), and 420 mm by age 6 (adults) (16.5 in.), with mean annual growth rates of adult and subadult fish slowing as fish become older (Osmundson et al. 1997). The largest fish reach lengths between 900 and 1000 mm (35 to 39 in.); these fish are quite old, likely being 47 to 55 years old with a minimum of 34 years (Osmundson et al. 1997).

Reproductive success and recruitment of Colorado pikeminnow is pulsed, with certain years having highly successful productivity and other years marked by failed or low success (U.S. Fish and Wildlife Service 2002b). The most successful years produce a large cohort of individuals that is apparent in the population over time. Once individuals reach adulthood, approximately 80 to 90 percent of adults greater than 500 mm (20 in.) survive each year (Osmundson et al. 1997; Osmundson and White 2009). Strong cohorts, high adult survivorship, and extreme longevity are likely life history strategies that allow the species to survive in highly variable ecological conditions of desert rivers.

POPULATION DYNAMICS

Population dynamics of the Colorado pikeminnow are measured separately in the Green, upper Colorado, and San Juan River basins, because distinct recovery criteria are delineated for each of these three basins (U.S. Fish and Wildlife Service 2002b). In the 2002 recovery plan, initial abundance estimates for wild adults in the basins were: upper Colorado River, 600 to 900; Green River, 6,000 to 8,000; and San Juan River, 19 to 50 (circa 2000 references for individual rivers found in U.S. Fish and Wildlife Service 2002b).

UPPER COLORADO RIVER – To monitor recovery of the Colorado pikeminnow, the Recovery Program conducts multiple-pass, capture-recapture sampling on two stretches of the upper Colorado River which are roughly above and below Westwater Canyon (Osmundson and White 2009). In the most recent summary of the data (Osmundson and White 2013, in draft) the principal investigators conclude that during the 19-year study period [1992-2010], the population remained self-sustaining. The current downlisting demographic criteria for Colorado pikeminnow (USFWS 2002b) in the Upper Colorado River Subbasin is a self-sustaining population of at least 700 adults maintained over a 5-year period, with a trend in adult point estimates that does not decline significantly. Secondarily, recruitment of age-6 (400–449 mm Total Length (TL)), naturally produced fish must equal or exceed mean adult annual mortality (estimated to be about 20 percent). The average of all adult estimates (1992 – 2010) is 644. The average of the five most recent annual adult population estimates is 658. Osmundson and White (2013) determined that recruitment rates were less than annual adult mortality in six years and exceeded adult mortality in the other six years when sampling occurred. The estimated net gain for the 12 years studied was 32 fish >450 mm TL. Whereas the Colorado River population appears to meet the trend or 'self-sustainability' criterion, it has not met the abundance criteria of 'at least 700 adults' during the most recent five year period (Figure 1).

GREEN RIVER – Population estimates for adult Colorado pikeminnow in the Green River subbasin began in 2000. Sampling occurs on the mainstem Green River from the confluence with the Yampa River to the confluence with the Colorado River and includes the Yampa and White Rivers (Bestgen et al. 2005). The initial year of sampling did not include the lower Green River (near the confluence of the White River to the confluence with the Colorado River). Beginning in 2001, the sampling regime has consisted of three years of estimates followed by two years of no estimates (Bestgen et al. 2005). The first set of estimates showed a declining trend; however, estimates collected in 2006–2008 showed an increasing trend approaching the level of the estimate made in 2000 (Figure 2) (Bestgen et al. 2010). Data from the third round of population estimates for years 2011–2013 for the Green River sub-basin are still being analyzed (thus no confidence intervals are shown for the 2011–2013 estimates in Figure 2). Preliminary results from this analysis indicate adults and sub-adults are in decline throughout the entire Green River sub-basin.

The downlisting demographic criteria for Colorado pikeminnow in the Green River subbasin require that separate adult point estimates for the middle Green River and lower Green River do not decline significantly over a 5-year period, and each estimate for the Green River subbasin exceeds 2,600 adults (estimated minimum viable population [MVP] number) (USFWS 2002b). The average of the first two sets of adult estimates was 3,020 (between 2000 – 2008).

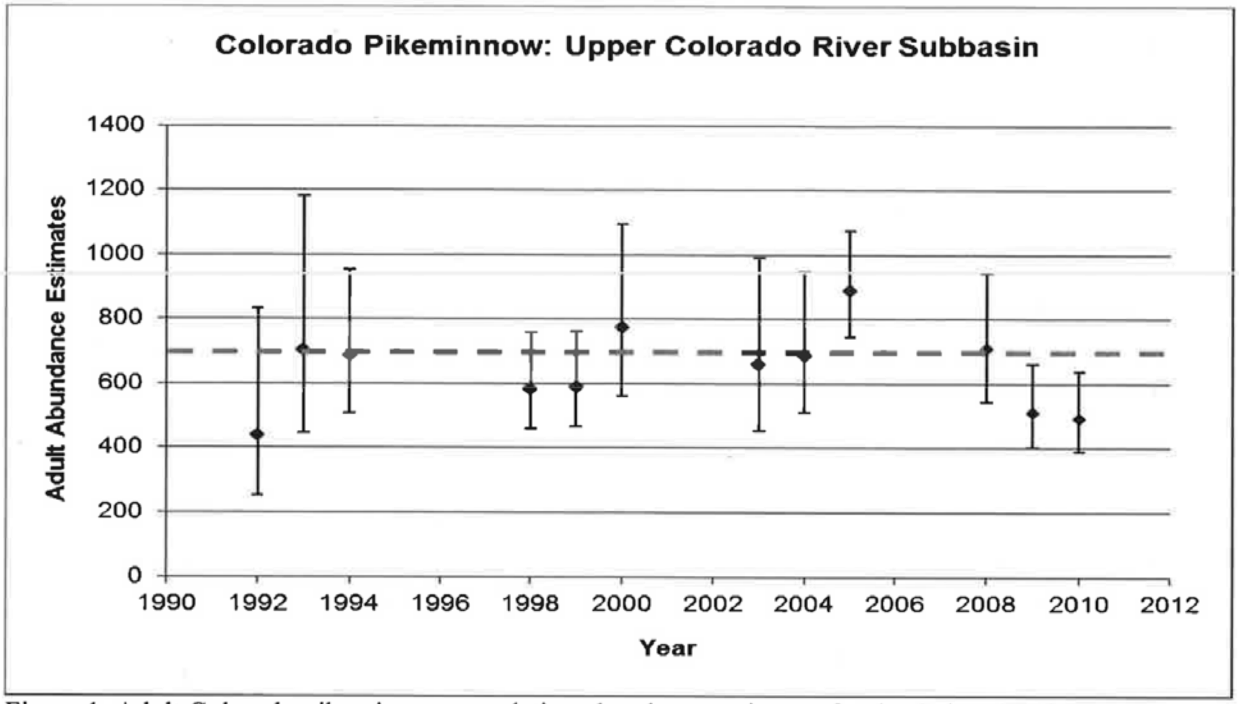

Figure 1. Adult Colorado pikeminnow population abundance estimates for the Colorado River (Osmundson and Burnham 1998; Osmundson and White 2009; 2013). Error bars represent the 95% confidence intervals. Dashed horizontal line represents the current population size downlist criterion.

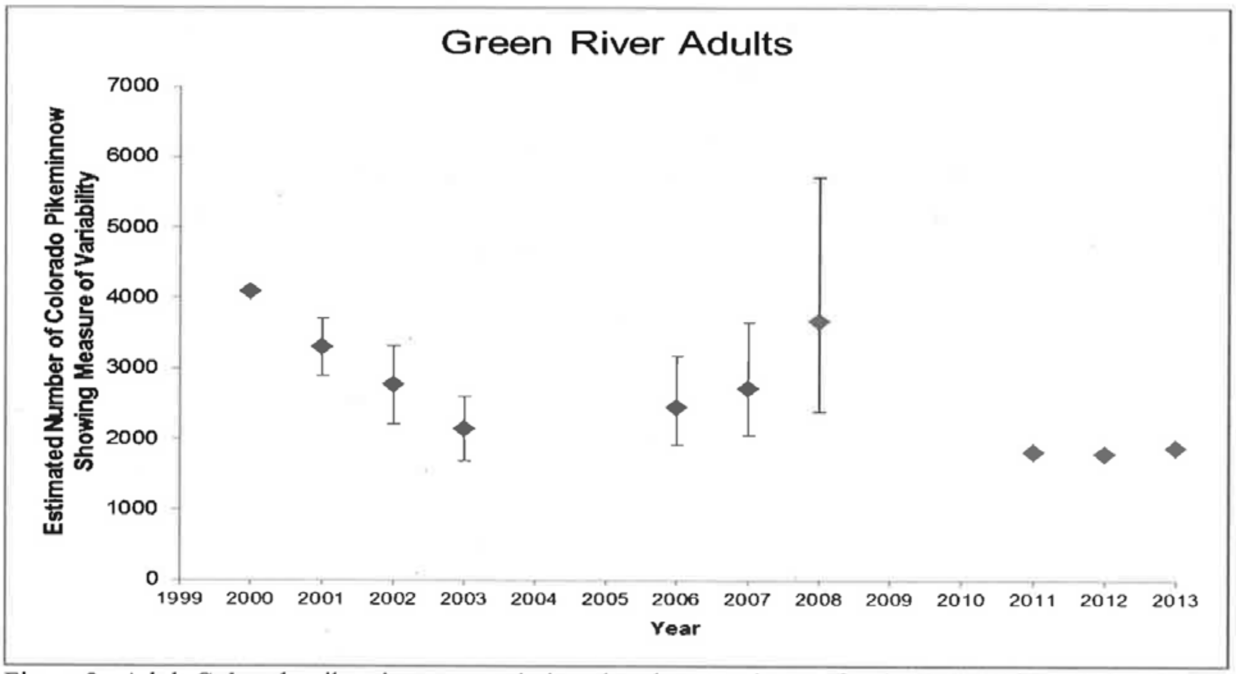

Figure 2. Adult Colorado pikeminnow population abundance estimates for the Green River (2000-2008 estimates from Bestgen et al. 2010; preliminary estimates from 2011-2013 (Bestgen, personal communication). Error bars represent the 95% confidence intervals. In 2000, the lower Green River was not sampled. Data depicted for 2000 incorporates an extrapolated lower Green River contribution to the overall population estimate and therefore lacks a confidence interval.

The downlisting demographic criteria for Colorado pikeminnow in the Green River subbasin also require that recruitment of age-6, naturally produced fish must equal or exceed mean annual adult mortality (USFWS 2002b). In general, the estimates of recruitment age fish have averaged 455 and have had a positive trend (Figure 3). Beginning in 2006, recruitment has exceeded the annual adult mortality of about 20 percent.

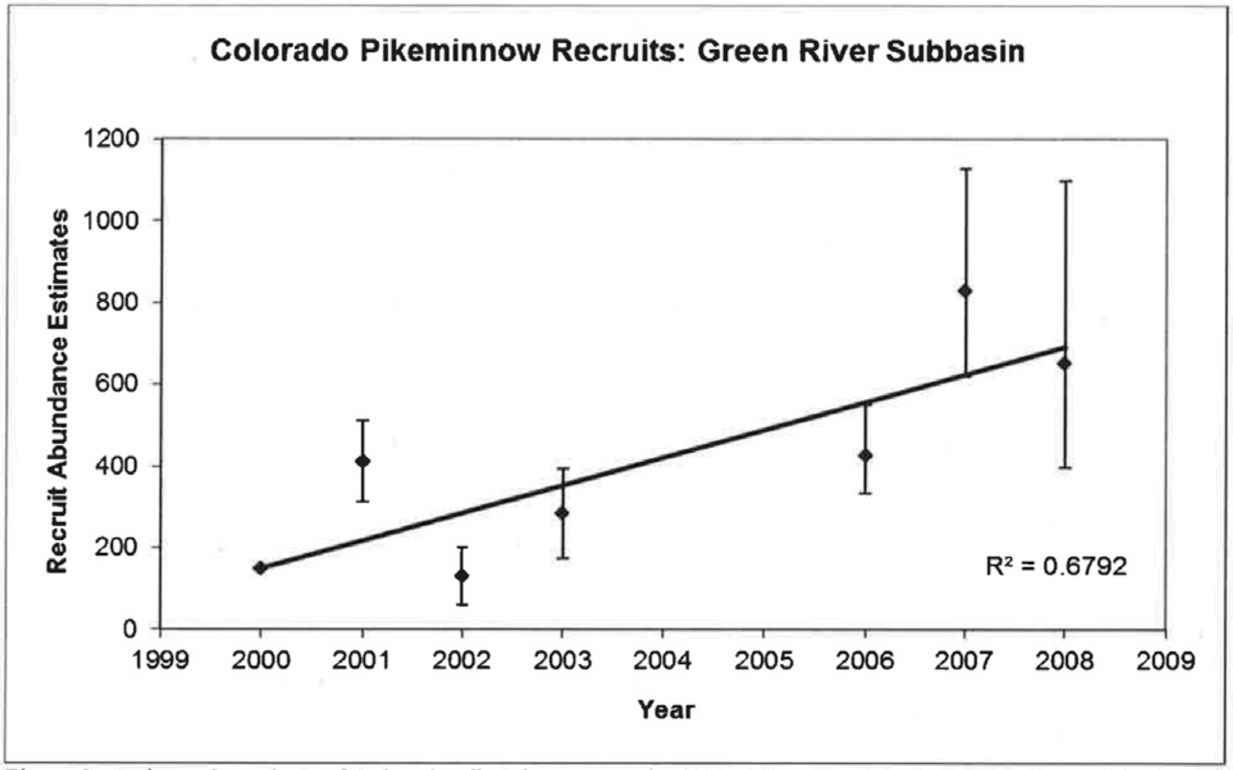

Figure 3. Estimated numbers of Colorado pikeminnow recruits (400–449 mm TL) in the Green River subbasin (Yampa, White, Middle Green, Desolation-Gray Canyons, and Lower Green) for 2001–2003 and 2006–2008. Error bars represent the 95% confidence intervals. Data from Bestgen et al. (2010). Estimates of recruitment for the most recent 2011-2013 sampling period are pending.

Bestgen et al. 2010 recognized that the mechanism driving frequency and strength of recruitment events was likely the strength of age-0 Colorado pikeminnow production in backwater nursery habitats. Osmundson and White (2013, in draft) saw a similar relationship between a strong age-0 cohort in 1986 and subsequent recruitment of late juveniles five years later, but that relationship was more tenuous in later years. Researchers are particularly concerned with what appears to be very weak age-0 representation in the Middle Green reach (1999 thru 2008) and in the lower Colorado River (2001 thru 2008) (Figure 4).

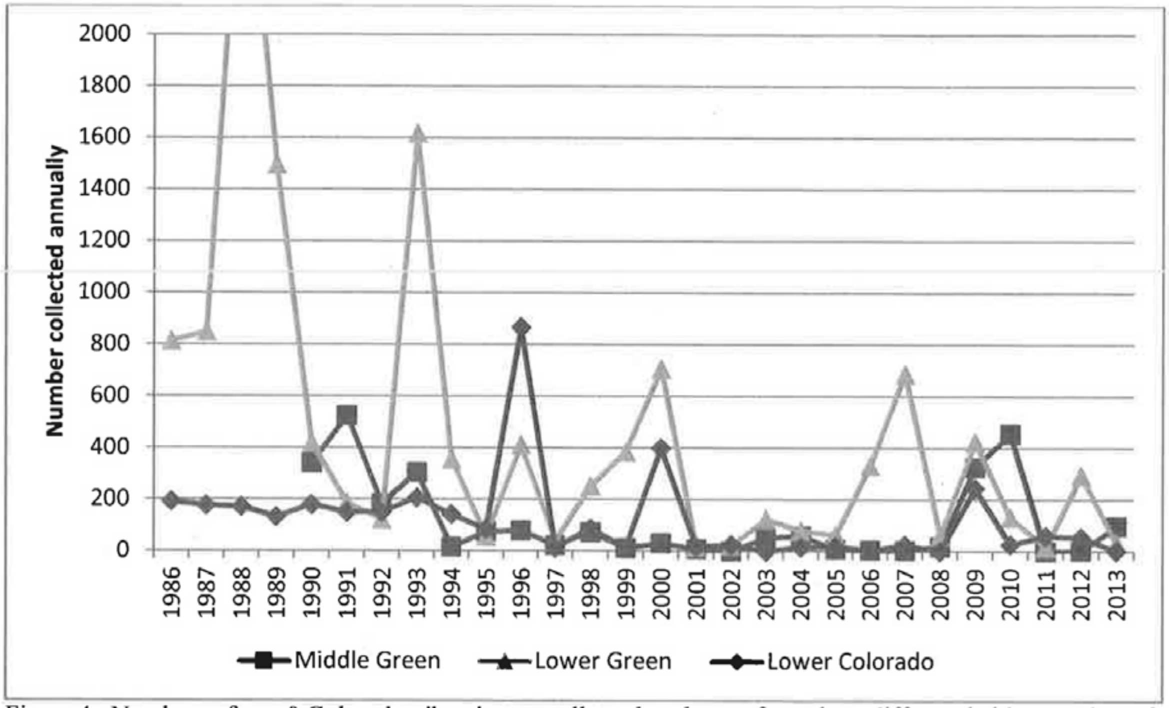

Figure 4. Numbers of age-0 Colorado pikeminnow collected each year from three different habitat reaches of river. A total of 2,892 Age-0 were collected in the lower Green River in 1988; the significance of strong Age-0 cohorts collected in the late 1980's was discussed in Bestgen et al. 2010. Data from Harding et al. 2013.

SAN JUAN RIVER – Unlike the Green and upper Colorado River Basins, wild Colorado pikeminnow are extremely rare in the San Juan River. The majority of individuals come from hatchery reared stocks supported by the San Juan River Recovery Implementation Program. This program has stocked more than 2 million age 0 and age 1+ fish in the San Juan River since 2002 (Furr and Davis 2009). No wild adults were collected since 2000 (Elverud 2008) and only five wild-spawned pikeminnow larvae were collected since 2002 (two in 2004; three in 2007) (Brandenburg and Farrington 2009).

In addition, adult Colorado pikeminnow collections in the San Juan River are extremely rare (Elverud 2008), indicating that many stocked fish do not reach sexual maturity. From 2002 to 2004, sampling conducted by the Utah Division of Wildlife Resources (UDWR) revealed low numbers of Colorado pikeminnow adults—presumably fish from the 1996 and 1997 stocking efforts—using the lower San Juan River in the spring and summer (Elverud 2008). No adult Colorado pikeminnow were collected between 2005 and 2008 in the lower San Juan River despite yearly sampling efforts (Elverud 2008).

River-wide population estimates for Colorado pikeminnow do not exist for the San Juan River (personal communication, Scott Durst 2009), but population estimates of individuals greater than 150 mm were generated after 2004 for the lower San Juan River (Elverud 2008). However, the observed variation in the population estimates within and among years makes identifying trends in the number Colorado pikeminnow difficult (Elverud 2008). In 2008, population estimates of Colorado pikeminnow greater than 150 mm in the lower San Juan River ranged from 270-572, depending on the model used (Elverud 2008).

BASIN-WIDE STATUS AND DISTRIBUTION

The Colorado pikeminnow was designated as an endangered species prior to enactment of the ESA, and therefore a formal listing package identifying threats was not assembled. Construction and operation of mainstem dams, nonnative fish species, and local eradication of native minnows and suckers in advance of new human-made reservoirs in the early 1960's were recognized as early threats (references in U.S. Fish and Wildlife Service 2002b). According to the 2002 Recovery Goals for the species, the primary threats to Colorado pikeminnow populations are streamflow regulation and habitat modification (including cold-water dam releases, habitat loss, and blockage of migration corridors); competition with and predation by nonnative fish species; and pesticides and pollutants (U.S. Fish and Wildlife Service 2002b). No new threats have emerged since the completion of this document.

As described in previous sections, Colorado pikeminnow are restricted to a portion of their historical range. Within currently occupied habitat, population trends are variable, with periods of noticeable decline, such as the early 2000s, and periods of population increase, such as the late 2000s. The current estimated population numbers in all three upper Colorado sub-basins are below estimates from the late 1990s, indicating that populations have not fully rebounded from the early 2000 population decline.

Major declines in Colorado pikeminnow populations occurred during the dam-building era of the 1930s through the 1960s. Behnke and Benson (1983) summarized the decline of the natural ecosystem, pointing out that dams, impoundments, and water use practices drastically modified the river's natural hydrology and channel characteristics throughout the Colorado River Basin. Dams on the mainstem broke the natural continuum of the river ecosystem into a series of disjunct segments, blocking native fish migrations, reducing temperatures downstream of dams, creating lacustrine habitat, and providing conditions that allowed competitive and predatory nonnative fishes to thrive both within the impounded reservoirs and in the modified river segments that connect them. The highly modified flow regime in the lower basin coupled with the introduction of nonnative fishes decimated populations of native fish.

Major declines of native fishes first occurred in the lower basin where large dams were constructed from the 1930s through the 1960s. In the Upper Basin, the following major dams were not constructed until the 1960s: Glen Canyon Dam on the mainstem Colorado River, Flaming Gorge Dam on the Green River, Navajo Dam on the San Juan River, and the Aspinall Unit Dams on the Gunnison River. To date, some native fish populations in the Upper Basin have managed to persist, while others have become nearly extirpated. River segments where native fish have declined more slowly than in other areas are those where the hydrologic regime most closely resembles the natural condition, such as the Yampa River, where adequate habitat for important life phases still exists, and where migration corridors are unblocked and allow connectivity among life phases.

RAZORBACK SUCKER

SPECIES DESCRIPTION

The largest native sucker to the western United States, the razorback sucker (*Xyrauchen texanus*) is a robust, river catostomid endemic to the Colorado River Basin (Sigler and Sigler 1996; U.S. Fish and Wildlife Service 2002d). The species feeds primarily on algae, aquatic insects, and other available aquatic macroinvertebrates using their ventral mouths and fleshy lips (Sigler and Sigler 1996). Adults can be identified by olive to dark brown coloration above, with pink to reddish brown sides and a bony, sharp-edged dorsal keel immediately posterior to the head, which is not present in the young (Sigler and Sigler 1996). The species can reach lengths of 3 feet and weights of 16 pounds (7.3 kg), but the maximum weight of recently captured fish is 11 to 13 pounds (5 to 6 kg) (Sigler and Sigler 1996; U.S. Fish and Wildlife Service 2002d). Taxonomically, the species is unique, belonging to the monotypic genus Xyrauchen, meaning that razorback sucker is the only species in the genus (U.S. Fish and Wildlife Service 2002d).

Historically, the razorback sucker occupied the mainstem Colorado River and many of its tributaries from northern Mexico through Arizona and Utah into Wyoming, Colorado, and New Mexico (U.S. Fish and Wildlife Service 2002d). In the late 19th and early 20th centuries, it was abundant in the Lower Colorado River Basin and common in parts of the Upper Colorado River Basin, with numbers apparently declining with distance upstream (references in U.S. Fish and Wildlife Service 2002d). Distribution and abundance of razorback sucker declined throughout the 20th century across its historic range, and the species now exists naturally only in a few small, unconnected populations or as dispersed individuals. Specifically, razorback sucker are currently found in small numbers in the Green River, upper Colorado River, and San Juan River sub-basins; the lower Colorado River between Lake Havasu and Davis Dam; Lakes Mead and Mohave; in small tributaries of the Gila River sub-basin (Verde River, Salt River, and Fossil Creek); and in local areas under intensive management such as Cibola High Levee Pond, Achii Hanyo Native Fish Facility, and Parker Strip (U.S. Fish and Wildlife Service 2002d).

The razorback sucker is listed as endangered under the Endangered Species Act of 1973, as amended (ESA; 16 U.S.C. 1531 et. seq.), under a final rule published on October 23, 1991 (56 FR 54957). The Service finalized the latest recovery plan for the species in 2002 (U.S. Fish and Wildlife Service 2002d) but is currently drafting an updated revision.

Fifteen reaches of the Colorado River system were designated as critical habitat for the razorback sucker on March 21, 1994 (59 FR 13374). These reaches total 2,776 km (1,724 mi) as measured along the center line of the river within the subject reaches. Designated critical habitat makes up about 49 percent of the species' original range and occurs in both the Upper and Lower Colorado River Basins. In the Upper Basin, critical habitat is designated for portions of the Green, Yampa, Duchesne, Colorado, White, Gunnison, and San Juan Rivers. Portions of the Colorado, Gila, Salt, and Verde Rivers are designated in the Lower Basin. The primary constituent elements are the same as those described for Colorado pikeminnow.

Separate, objective recovery criteria were developed for each of two recovery units (the Upper Colorado and Lower Colorado River Basins as delineated at Glen Canyon Dam) to address unique threats and site specific management actions necessary to minimize or remove those threats. This biological opinion's focus is on the Upper Colorado River Basin recovery unit and will therefore describe the status of the razorback sucker in that unit.

LIFE HISTORY

Except during periods before and after spawning, adult razorback sucker are thought to be relatively sedentary and have high fidelity to overwintering sites (U.S. Fish and Wildlife Service 2002d). Adults become sexually mature at approximately 4 years and lengths of 400 mm (16 in.) (Zelasko et al. 2009), at which time they travel long distances to reach spawning sites (U.S. Fish and Wildlife Service 2002d). Mature adults breed in spring (mostly April–June) on the ascending limb of the hydrograph, congregating over cobble/gravel bars, backwaters, and impounded tributary mouths near spawning sites (multiple references in U.S. Fish and Wildlife Service 2002d; Snyder and Muth 2004; Zelasko et al. 2009). Flow and water temperature cues may play an important role prompting razorback adults to aggregate prior to spawning (Muth et al. 2000).

Razorback sucker have high reproductive potential, with reported average female fecundity of approximately 50,000 to 100,000 eggs per fish (U.S. Fish and Wildlife Service 2002d). They are broadcast spawners that scatter adhesive eggs over gravel-cobble substrate (Snyder and Muth 2004). High springs flows are important to egg survival because they remove fine sediment that can otherwise suffocate eggs. Hatching is limited at temperatures less than 10°C (50° F) and best around 20°C (68° F) (Snyder and Muth 2004). Eggs hatch 6 to 11 days after being deposited and larval fish occupy the sediment for another 4 to 10 days before emerging into the water column. Larval fish occupy shallow, warm, low-velocity habitats in littoral zones, backwaters, and inundated floodplains and tributary mouths downstream of spawning bars for several weeks before dispersing to deeper water (U.S. Fish and Wildlife Service 2002d; Snyder and Muth 2004). It is believed that low survival in early life stages, attributed to loss of nursery habitat and predation by non-native fishes, causes extremely low recruitment in wild populations (Muth et al. 2000).

Razorback sucker in the Upper Basin tend to be smaller and grow slower than those in the Lower Basin, reaching 100 millimeters (4 in.) on average in the first year (U.S. Fish and Wildlife Service 2002b). Based on collections in the middle Green River, typical adult size centers around 510 mm (20 in.) (Modde et al. 1996). Razorback suckers are long-lived fishes, reaching 40+ years via high annual survival (U.S. Fish and Wildlife Service 2002d). Adult survivorship was estimated to be 71 to 73 percent in the Middle Green River from 1980-1992 (Modde et al. 1996; Bestgen et al. 2002) and 76 percent from 1990 to 1999 (Bestgen et al. 2002).

POPULATION DYNAMICS

Population estimates during the 1980 to 1992 period were on average between 300 and 600 wild fish (Modde et al. 1996). By the early 2000s, the wild population consisted of primarily aging adults, with steep decline in numbers caused by extremely low natural recruitment (U.S. Fish and Wildlife Service 2002d). Although reproduction was occurring, very few juveniles were found (U.S. Fish and Wildlife Service 2002d).

In the early part of the 2000s, population numbers were extremely low. Population estimates from sampling efforts in the Middle Green River had declined to approximately 100 by 2002, with researchers hypothesizing that wild fish in the Green River Basin could become extirpated because of lack of recruitment (Bestgen et al. 2002). Similarly, in the upper Colorado River, razorback sucker were exceedingly rare. In the 2002 recovery plan, razorback sucker were considered extirpated in the Gunnison River, where fish were last captured in 1976 (U.S. Fish and Wildlife Service 2002d). Similarly, in the Grand Valley, only 12 fish were collected from 1984 to 1990, despite intensive sampling (Osmundson and Kaeding 1991 in U.S. Fish and Wildlife Service 2002d). No young razorback sucker were captured in the Upper Colorado River since the mid-1960s (Osmundson and Kaeding 1991 in U.S. Fish and Wildlife Service 2002d). In the San Juan River we know of only two wild razorback suckers that were captured in 1976 in a riverside pond near Bluff, Utah, and one fish captured in the river in 1988, also near Bluff (Ryden 2006). No wild razorback suckers were found during the 7-year research period (1991–1997) of the San Juan River Basin Recovery Implementation Program (Ryden 2006).

Because of the low numbers of wild fish and lack of recruitment, augmenting the remaining wild populations with hatchery-raised fish is a key step to creating self-sustaining populations. The Recovery Program is rebuilding razorback sucker populations with hatchery stocks. As populations increase, the Program expects to generate mark-recapture population estimates on adult razorback sucker comparable to the data reported for Colorado pikeminnow and humpback chub. Many stocked razorback sucker are being recaptured as part of other studies. Razorback sucker stocked in the Green and Colorado Rivers have been recaptured in reproductive condition and often in spawning groups. Captures of larvae in the Green, Gunnison, and Colorado Rivers document reproduction is occurring. Survival of larvae through their first year remains rare, largely due to a decrease in the availability of warm, food-rich floodplain areas and predation by a suite of nonnatives when the flood plain nursery habitats are available (Bestgen et al. 2011). However, occasional captures of juveniles (just over age-1) in the Green and Gunnison Rivers suggest that survival of early life stages is occurring. Collections of larvae by light trap in the middle Green River have generally increased since 2003; in 2012, the largest collection of light trapped larvae occurred (4,196; Figure 5). In 2011, researchers documented spawning by razorback sucker in the White River for the first time.

Since 1995, over 334,000 subadult razorback suckers have been stocked in the Green and upper Colorado River subbasins. Two reports on survival estimates of stocked razorback sucker recommended stocking larger fish during spring, fall and winter (Zelasko et al. 2009; 2011). From 2004–2007 approximately 96,400 fish were stocked and 1,511 recapture events from 1,470 unique individuals were encountered from 2005–2008. In 2012, tag-reading antennae were placed on a spawning bar in the middle Green River near Dinosaur National Monument in northeast Utah. Fifty-two unique razorback sucker stocked between 2004 and 2010 were detected, 88 percent of which had not been seen since stocking. During sampling for Colorado pikeminnow estimates, 938 and 765 razorback sucker were captured in 2011 and 2012, respectively, for the Ouray to Green River, Utah reach of the main channel of the Green River. In a monitoring plan (Bestgen et al. 2012), estimates of large juvenile to adult razorback sucker in three reaches of the Green River ranged from 474 to over 5,000 within a reach. Although these estimates are highly imprecise, they provide further confirmation that stocked fish are surviving in the wild.

Three razorback sucker stocked in the San Juan River near Farmington, New Mexico for the San Juan Recovery Program were captured between Moab, Utah and the state line with Colorado in

2008. This demonstrates that exchange of stocked razorback sucker between the San Juan River and the Upper Colorado River is certain, and may have ramifications for recovery.

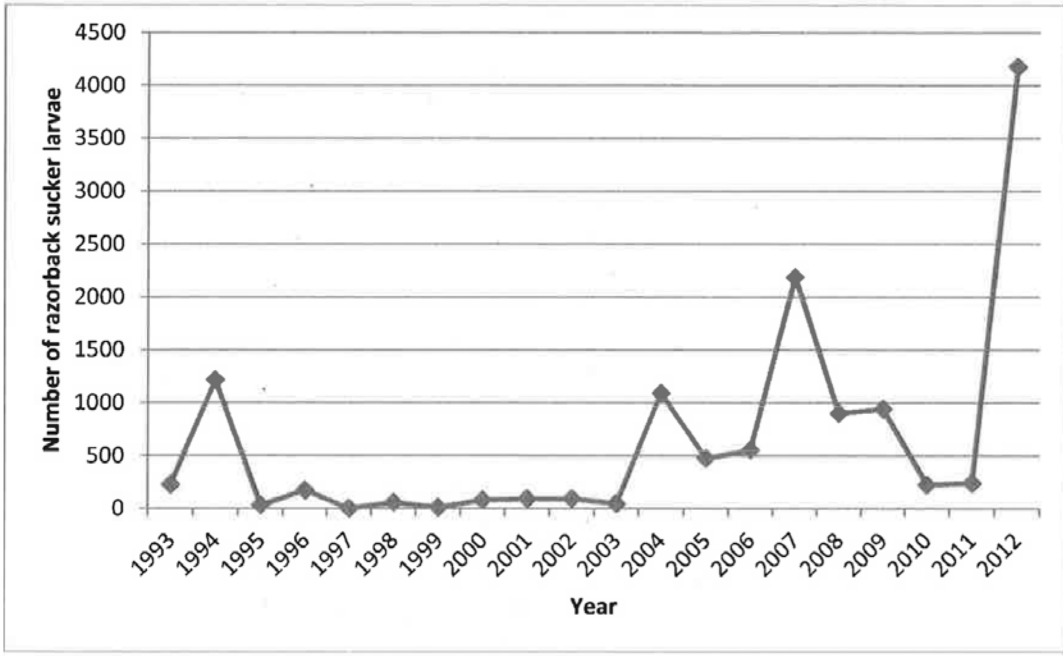

Figure 5. Numbers of razorback sucker larvae collected in light traps since 2000.

BASIN-WIDE STATUS AND DISTRIBUTION

The razorback sucker was designated as endangered under a final rule published on October 23, 1991 (56 FR 54957). Population conditions cited in the rule include little evidence of natural recruitment over the previous 30 years and a downward trend relative to historic abundance over the previous 10 years. Threats to species centered on significant changes to natural habitat conditions, including diversion and depletion of water, introduction of nonnative fishes, and construction and operation of dams.

Monitoring of wild razorback sucker in the Upper Colorado River Basin shows continued declines in abundance, hypothesized to be from a lack of recruitment. Therefore, recovery of the species has focused on augmentation of populations through hatchery-raised fish and habitat improvements.

According to the 2002 Recovery Goals for the species, the primary threats to razorback sucker populations are streamflow regulation and habitat modification (including cold-water dam releases, habitat loss, and blockage of migration corridors); competition with and predation by nonnative fish species; and pesticides and pollutants (U.S. Fish and Wildlife Service 2002d). No new threats have emerged since the completion of this document. The Service's status review of razorback sucker completed in 2012 (USFWS 2012b) reported that 85 percent of the downlisting recovery factor criteria (USFWS 2002c) have been addressed to varying degrees; however, nonnative fish species continue to be problematic.

HUMPBACK CHUB

SPECIES DESCRIPTION

The humpback chub (*Gila cypha*) is a medium-sized freshwater fish of the minnow family endemic to the Colorado River basin. The species evolved around 3 to 5 million years ago (Sigler and Sigler 1996). The pronounced hump behind its head gives the humpback chub a striking, unusual appearance. It has an olive-colored back, silver sides, a white belly, small eyes, and a long snout that overhangs its jaw (Sigler and Sigler 1996). This fish can grow to nearly 500 mm (20 in.) and may survive more than 30 years in the wild (U.S. Fish and Wildlife Service 2002c). The humpback chub does not have the swimming speed or strength of species such as the Colorado pikeminnow. Instead, it uses its large fins to "glide" through slow-moving areas, feeding on insects.

Historic distribution is surmised from various reports and collections that indicate the species inhabited canyons of the Colorado River and four of its tributaries: the Green, Yampa, White, and Little Colorado Rivers. Presently the species occupies about 68 percent of its historic habitat (U.S. Fish and Wildlife Service 2002c). Historic to current abundance trends are unclear because historic abundance is unknown (U.S. Fish and Wildlife Service 2002c).

Currently, five wild populations occur upstream of Glen Canyon Dam (Figure 6) and two downstream (U.S. Fish and Wildlife Service 2002c). In the Upper Colorado River Basin the two most stable populations are found near the Colorado/Utah border: one at Westwater Canyon in Utah; and one in an area called Black Rocks, in Colorado (Upper Colorado River Endangered Fish Recovery Program and San Juan River Basin Recovery Implementation Program 2010). Smaller numbers in the Upper Basin were found in the Yampa and Green Rivers in Dinosaur National Monument, Desolation and Gray Canyons on the Green River in Utah, and Cataract Canyon on the Colorado River in Utah (U.S. Fish and Wildlife Service 2002c). The two populations in the Lower Colorado River Basin occur in the mainstem Colorado and Little Colorado Rivers. The Little Colorado River population, found in the Grand Canyon, is the largest known population, harboring up to 10,000 fish (U.S. Fish and Wildlife Service 2002c).

The Office of Endangered Species first included the humpback chub in the List of Endangered Species on March 11, 1967 (32 FR 4001). Subsequently, it was considered endangered under provisions of the Endangered Species Conservation Act of 1969 (16 U.S.C. 668aa) and was included in the United States List of Endangered Native Fish and Wildlife issued on June 4, 1973 (38 FR No. 106). It is currently protected under the Endangered Species Act of 1973 as an endangered species throughout its range (ESA; 16 U.S.C. 1531 et. seq.). The Service finalized the latest recovery plan for the species in 2002 (U.S. Fish and Wildlife Service 2002d), but is currently drafting an updated revision.

The Service designated seven reaches of the Colorado River System as critical habitat for the humpback chub on March 21, 1994 (59 FR 13374). These reaches total 610 km (379 mi) as measured along the center line of each reach. Designated critical habitat makes up about 28 percent of the species' original range and occurs in both the Upper and Lower Colorado River Basins. In the Upper Colorado River Basin, critical habitat includes portions of the Yampa, Green, and Colorado Rivers, primarily including canyon habitats, such as Yampa, Desolation and Gray, Westwater, and Cataract Canyons. Although humpback chub life history and habitat use differs greatly from the other endangered Colorado River fish, the primary constituent elements (water, physical habitat, and biological environment) of their critical habitat are the same (see above).

Figure 6. Locations of humpback chub populations in the Upper Colorado River Basin. Taken from Page 12 of Upper Colorado River Endangered Fish Recovery Program and San Juan River Basin Recovery Implementation Program 2010).

Separate, objective recovery criteria were developed for each of two recovery units (the Upper Colorado and Lower Colorado River Basins as delineated at Glen Canyon Dam) to address unique threats and site-specific management actions necessary to minimize or remove those threats. This biological opinion's focus is on the Upper Colorado River Basin recovery unit and will therefore describe the status of the humpback chub in that unit.

LIFE HISTORY

Like other large desert river fishes, the humpback chub is an obligate warm-water species that requires relatively warm temperatures for spawning, egg incubation, and survival of larvae. Unlike Colorado pikeminnow and razorback sucker, which are known to make extended migrations of up to several hundred miles to spawning areas, humpback chubs do not appear to make extensive migrations. Instead, humpback chub live and complete their entire life cycle in canyon-bound reaches of the Colorado River mainstem and larger tributaries characterized by deep water, swift currents, and rocky substrates (U.S. Fish and Wildlife Service 2002c). Individuals show high fidelity for canyon reaches and move very little.

Mature humpback chub typically spawn on the descending hydrograph between March and July in the Upper Basin (Karp and Tyus 1990). Humpback chub are broadcast spawners who may mature as young as 2 to 3 years old. Eggs incubate for three days before swimming up as larval fish (U.S. Fish and Wildlife Service 2002c). Egg and larvae survival are highest at temperatures close to 19 to 22 degrees Celsius (U.S. Fish and Wildlife Service 2002c). Unlike larvae of other Colorado River fishes (e.g., Colorado pikeminnow and razorback sucker), larval humpback chub show no evidence of long-distance drift (Robinson et al.1998).

Recruitment appears to be successful in all known Upper Basin populations (U.S. Fish and Wildlife Service 2002c). Survival of humpback chub during the first year of life is low, but increases through the first 2 to 3 years of life with decreased susceptibility to predation, starvation, and environmental changes. Survival from larvae to adult life stages was estimated at 0.1 percent (0.001) (Valdez and Ryel 1995, 1997 in U.S. Fish and Wildlife Service 2002c). Survival of adults is high, with estimates approximating 75 percent based on Grand Canyon adults (U.S. Fish and Wildlife Service 2002c).

Growth rates of humpback chub vary by populations, with fish in the Upper Basin growing slower than those in the Grand Canyon (U.S. Fish and Wildlife Service 2002c). Individuals in Cataract Canyon were 50, 100, 144, 200, 251, and 355 mm total length from 1 to 6 years, respectively (Valdez 1990 in U.S. Fish and Wildlife Service 2002c). Based on sexual maturity and age-to-length ratios, adults are classified as those fish 200 mm or longer. Maximum life span is estimated to be 30 years in the wild.

Humpback chub move substantially less than other native Colorado River fishes, and studies consistently show high fidelity by humpback chub for specific riverine locales occupied by respective populations. Despite remarkable fidelity for given river regions, individual humpback chub adults are known to move between populations. Movement by juveniles is not as well documented but is also believed to be limited in distance. For example, no out-migration by young fish is seen from population centers such as Black Rocks and Westwater Canyon.

POPULATION DYNAMICS

Five wild populations of humpback chub inhabit canyon-bound sections of the Colorado, Green, and Yampa Rivers: Yampa Canyon; Desolation and Gray Canyons; Cataract Canyon; Black Rocks; and Westwater Canyon. Recovery goal downlisting demographic criteria (USFWS 2002c) for humpback chub require each of five populations in the upper Colorado River basin to be self-sustaining over a 5-year period, with a trend in adult point estimates that does not decline significantly. Secondarily, recruitment of age-3 (150–199 mm TL) naturally produced fish must equal or exceed mean adult annual mortality. In addition, one of the five populations (e.g., Black Rocks/Westwater Canyon or Desolation/Gray Canyons) must be maintained as a core population such that each estimate exceeds 2,100 adults (estimated minimum viable population number).

The Yampa River humpback chub population exists in the lower Yampa River Canyon and into the Green River through Split Mountain Canyon. This population is small, with an estimate of about 400 wild adults in 1998 2000. Sampling during 2003–2004 caught only 13 fish, too few to estimate population size (Finney 2006). In 2007, the Recovery Program brought 400 young-of-year *Gila* spp. caught in Yampa Canyon into captivity as a research activity to determine the best methods for capture, transport, and holding at two different hatchery facilities. Approximately 15 percent of the *Gila* species were tentatively identified as humpback chub by physical characteristics. Geneticists at Southwest Native Aquatic Resources and Recovery Center (SNARRC), Dexter, NM, have since provided preliminary results indicating that the Yampa fish in captivity were hybrids between humpback chub and roundtail chub (Wade Wilson, U.S. Fish and Wildlife Service, personal communication). These fish were considered unsuitable for broodstock and were released into the Green River in Dinosaur National Monument. Currently, it is not known if pure humpback chubs occur in Yampa Canyon.

The Desolation/Gray Canyons population of wild adults was estimated at 1,300 in 2001, 2,200 in 2002, and 940 in 2003 (Jackson and Hudson 2005). Sampling in 2001 and 2002 was conducted in summer, whereas beginning in 2003, sampling was shifted to fall to avoid capturing Colorado pikeminnow that use Desolation Canyon for spawning. In a report on 2006–2007 estimates, researchers (Badame 2012; Figure 7) indicated that this population was trending downward. The declining catch of humpback chub in the upper portions of Desolation Canyon in the 2006–2007 estimates was linked to increasing densities of nonnative smallmouth bass (Badame 2012). Researchers recommended securing a representative sample of adults in captivity. In 2009, 25 adults were taken to Ouray National Fish Hatchery. In 2011, six sites throughout Desolation Canyon were monitored for adults, 55 individual adults were encountered, but recaptures were too few to calculate a population estimate.

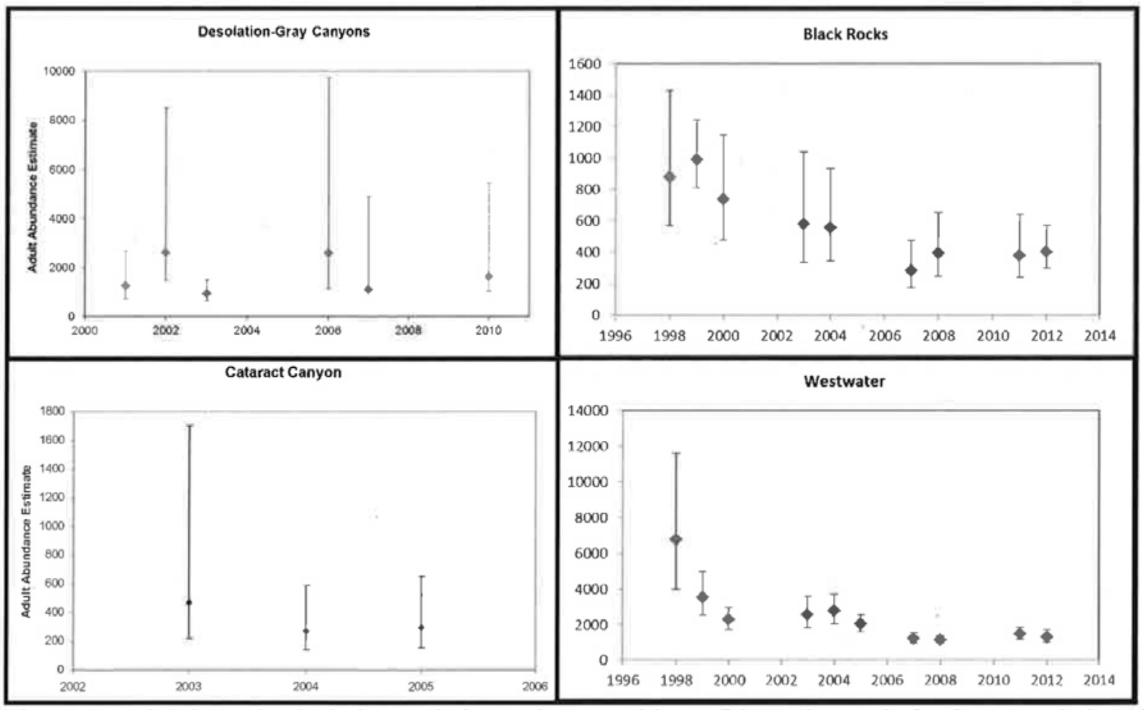

Figure 7. Adult humpback chub population estimates with confidence intervals for four populations in the upper Colorado River Basin (note: the scale differs among the graphs for the different populations). Clockwise from upper left: Desolation-Gray Canyons (Badame 2011, 2012); Black Rocks (Francis and McAda 2011); Westwater Canyon (Elverud 2011); and Cataract Canyon (Badame 2008).

On the Colorado River of the upper Colorado River basin, three humpback chub populations are recognized. Black Rocks and Westwater Canyon have enough exchange of individuals that they are considered a single core population. In Black Rocks, estimates of wild adults have varied from about 800 in 1998, 900 in 1999, and 500 in 2000 and 2003 (Figure 7) (McAda 2007). The most recent estimates, in 2007–2008 were 345 and 287, respectively. During the fall of 2011 and 2012, 78 and 112 individual adult humpback chub were caught respectively - similar to the numbers caught in 2007 and 2008 (61 and 74, respectively). Population estimates for Black Rocks for 2011 and 2012 were 379 and 403, respectively. Unfortunately, 78 largemouth bass were collected in Black Rocks in 2012, a ten-fold increase over the 2011 catch. The Westwater

Canyon estimates of wild adults range from about 4,700 in 1998 to 2,500 in 1999, 2000, and 2003 (Jackson and Hudson 2005). The 2007–2008 estimates were about 1,750 and 1,300. The large declines in humpback chub densities in both Black Rocks and Westwater Canyons occurred in the late 1990's and are not attributed to more recent increases of nonnative predators in the Colorado River.

In 2008, the core population (Black Rocks / Westwater combined) dropped below the population size downlist criterion (MVP = 2,100 adults) for the first time. In 2011, populations recovered slightly in Westwater Canyon where the adult estimate was 1,467; however, UDWR reported 1,315 adults in 2012. The core population estimates in 2011 and 2012 were 1846 and 1718, respectively (Figure 8). Population estimates in both Black Rocks and Westwater canyons declined dramatically during the first population estimation rotation in the late 1990s, but have remained relatively stable since that time. Colorado State University's recent robust population estimate analysis more clearly indicated that declines in the Westwater and Black Rock humpback chub populations are due to lapses in recruitment (i.e. adult survival rates have remained stable). Principle investigators agree that reinitiating an age-0 monitoring component is advisable. It should be noted that whatever is affecting humpback chub recruitment has not affected sympatric populations of native roundtail chub; populations of roundtail chub in both canyons have remained stable or have increased since population estimation started. In addition to the potential and recent negative interactions between humpback chub and nonnative predators discussed above, both the Westwater and Black Rocks populations are at risk of potential chemical contamination due to the proximity of a railroad located on the right bank of the Colorado River which at times transports toxic substances.

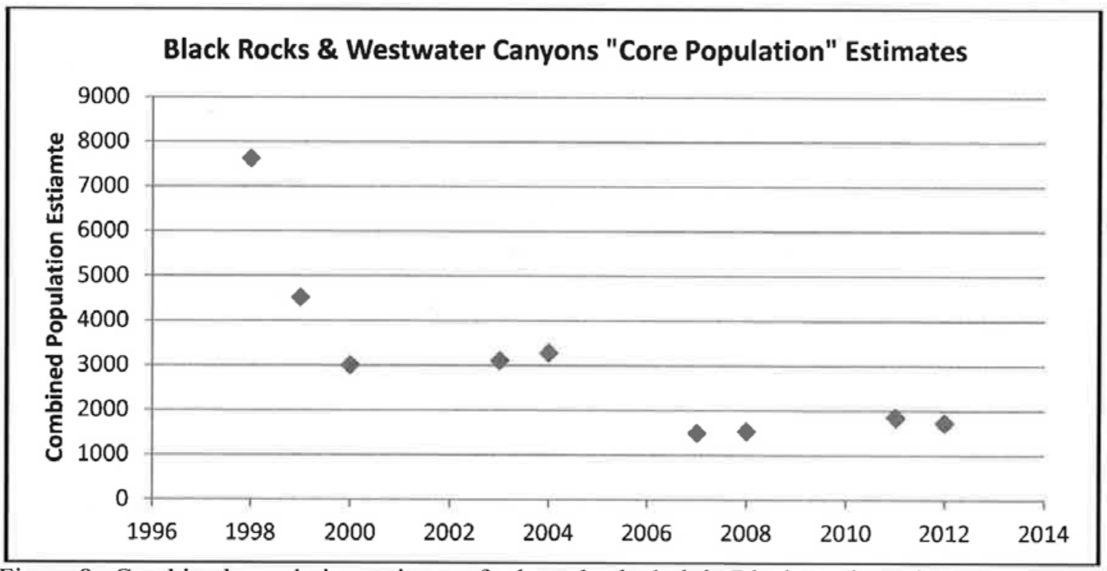

Figure 8. Combined population estimates for humpback chub in Black Rocks and Westwater Canyon based on a robust open model created by Dr.'s Bestgen and White, Colorado State University. The 2002 Recovery Goal downlist criteria for these combined ("core population") estimates is 2,100 adults.

The Cataract Canyon humpback chub population is small, with estimates of about 150 wild adults in 2003 and 66 in 2005 (Badame 2008). Estimates are difficult to obtain in Cataract; therefore, catch-per-unit-effort (CPUE) has been determined to be an effective replacement (began in 2008 on a 2 years on, 2-years-off sampling regime). In 2011, UDWR reported that the Cataract population appears to be stable with CPUE ranging between 0.010 and 0.035 fish/net-hour. Despite additional effort to sample below Big Drop Rapid, no additional humpback chub were encountered in the new riverine habitat created by low Lake Powell levels.

BASIN-WIDE STATUS AND DISTRIBUTION

The humpback chub was designated as an endangered species prior to enactment of the ESA, and therefore, a formal listing package identifying threats was not assembled. Construction and operation of mainstem dams, nonnative fish species, and local eradication of native minnows and suckers in advance of new human-made reservoirs in the early 1960's were recognized as early threats (U.S. Fish and Wildlife Service 2002c). According to the 2002 Recovery Goals for the species, the primary threats to humpback chub are streamflow regulation, habitat modification, predation by non-native fish species, parasitism, hybridization with other native *Gila* species, and pesticides and pollutants (U.S. Fish and Wildlife Service 2002c). No new threats have emerged since the completion of this document. The Service's status review of humpback chub completed in 2011 (USFWS 2011b) reported that 60 percent of the recovery factor criteria (USFWS 2002c) have been addressed to varying degrees; however, nonnative fish species and issues dealing with the potential chemical contamination of the river from spills and pipelines continue to be problematic.

As described in previous sections, humpback chub are restricted to a portion of their historical range. Within currently occupied habitat in the Upper Basin, population trends are variable, with one core population remaining quite robust, but other populations threatened with extirpation.

BONYTAIL

SPECIES DESCRIPTION

The bonytail (*Gila elegans*) is a medium-sized freshwater fish in the minnow family, endemic to the Colorado River Basin. The species evolved around 3 to 5 million years ago (Sigler and Sigler 1996). Individuals have large fins and a streamlined body that typically is very thin in front of the tail. They have a gray or olive-colored back, silver sides, and a white belly (Sigler and Sigler 1996). The mouth is slightly overhung by the snout and there is a smooth low hump behind the head that is not as pronounced as the hump on a humpback chub. A very close relative to the roundtail chub (*Gila robusta*), bonytail can be distinguished by counting the number of rays in the fins, with bonytail having 10 dorsal and anal fin rays (Sigler and Sigler 1996). The fish can grow to be 600 mm (24 in.) and are thought to live as long as 20 to 50 years (Sigler and Sigler 1996). Little is known about the specific food and habitat of the bonytail because the species was extirpated from most of its historic range prior to extensive fishery surveys, but it is considered adapted to mainstem rivers, residing in pools and eddies, while eating terrestrial and aquatic insects (U.S. Fish and Wildlife Service 2002a).

Bonytail were once widespread in the large rivers of the Colorado River Basin (multiple historic references in U.S. Fish and Wildlife Service 2002a). The species experienced a dramatic, but poorly documented, decline starting in about 1950, following construction of mainstem dams, introduction of nonnative fishes, poor land-use practices, and degraded water quality (U.S. Fish and Wildlife Service 2002a). Population trajectory over the past century and reasons for decline are unclear because lack of basin-wide fishery investigations precluded accurate distribution and abundance records.

Bonytail are now rarely found in the Green and Upper Colorado River sub-basins and are the rarest of all the endangered fish species in the Colorado River Basin. In fact, no wild, self-sustaining populations are known to exist upstream of Lake Powell; this fish is nearly extinct. In the last decade only a handful of bonytail were captured on the Yampa River in Dinosaur National Monument, on the Green River at Desolation and Gray canyons, and on the Colorado River at the Colorado/Utah border and in Cataract Canyon. In the lower basin, bonytail exist in Lake Mohave and Lake Havasu.

The bonytail is currently listed as endangered under the Endangered Species Act of 1973, as amended (ESA; 16 U.S.C. 1531 et. seq.), under a final rule published on April 23, 1980 (45 FR 27710). The Service finalized the latest recovery plan for the species in 2002 (U.S. Fish and Wildlife Service 2002a), but is currently drafting an updated revision.

The Service designated seven reaches of the Colorado River as critical habitat for the bonytail on March 21, 1994 (59 FR 13374). These reaches total 499 km (312 mi) as measured along the center line of each reach. Portions of the Green, Yampa, and Colorado Rivers are designated as critical habitat, representing about 14 percent of the species' historic range. The primary constituent elements are the same as those described for Colorado pikeminnow, razorback sucker, and humpback chub.

Separate, objective recovery criteria were developed for each of two recovery units (the Upper Colorado and Lower Colorado River Basins as delineated at Glen Canyon Dam) to address unique threats and site specific management actions necessary to minimize or remove those threats. This biological opinion's focus is on the Upper Colorado River Basin recovery unit and will therefore describe the status of the humpback chub in that unit.

LIFE HISTORY

Natural reproduction of bonytail was last documented in the Green River in 1959, 1960, and 1961 at water temperatures of 18°C (U.S. Fish and Wildlife Service 2002a). Similar to other closely related *Gila* species, bonytail in rivers probably spawn during spring over rocky substrates. While age at sexually maturity is unknown, they are capable of spawning at 5 to 7 years old. Recruitment and survival estimates are currently unknown because populations are not large enough for research to occur.

Individuals in Lake Mohave have reached 40 to 50 years of age (U.S. Fish and Wildlife Service 2002a), but estimates for river inhabiting fish are not available.

POPULATION DYNAMICS

Bonytail are so rare that it is currently not possible to conduct population estimates. In response to the low abundance of individuals, the Recovery Program is implementing a stocking program to reestablish populations in the Upper Basin; stocking goals were met or exceeded the past three years (Upper Colorado River Endangered Fish Recovery Program and San Juan River Basin Recovery Implementation Program 2010). Since 1996, over 380,000 tagged bonytail subadults have been stocked in the Green and upper Colorado River subbasins.

To date, stocked bonytail do not appear to be surviving as well as stocked razorback sucker. Researchers continue to experiment with pre-release conditioning and exploring alternative release sites to improve their survival. Since 2009, an increasing number of bonytail have been detected at several locations throughout the Upper Colorado River Basin where stationary tag-reading antennas are used. During high spring flows in 2011, more than 1,100 bonytail (16.6% of the 6,804 stocked in early April of that year) were detected by antenna arrays in the breach of the Stirrup floodplain on the Green River. The Price Stubb antenna array on the Colorado River detected 138 bonytail between October 2011 and September 2013. The fish detected in fall 2011 had been stocked above Price-Stubb in Debeque Canyon, but in spring 2012, some of those fish were moving upstream through the fish passage.

BASIN-WIDE STATUS AND DISTRIBUTION

The bonytail was designated as an endangered species under a final rule published April 23, 1980 (45 FR 27710–27713). Reasons for decline of the species were identified as the physical and chemical alteration of their habitat and introduction of exotic fishes. The 1990 Bonytail Chub Recovery Plan further stated that the decline of the bonytail is attributed to stream alteration caused by construction of dams, flow depletion from irrigation and other uses, hybridization with other *Gila*, and the introduction of nonnative fish species. Hence, the primary threats to bonytail populations are streamflow regulation and habitat modification (including cold-water dam releases, habitat loss, and blockage of migration corridors); competition with and predation by nonnative fish species; hybridization; and pesticides and pollutants (U.S. Fish and Wildlife Service 2002a). No new threats have emerged since the 2002 recovery goals were published. The Service's status review of bonytail in 2012 (USFWS 2012a) reported that 72 percent of the recovery factor criteria (USFWS 2002d) have been addressed to varying degrees.

No known wild, self-sustaining populations of bonytail exist in the Upper Basin. Since listing, bonytail were stocked in the Upper Basin to augment populations, but recruitment and natural reproduction have not been documented. Recent recaptures of bonytail in the Green River a year after stocking provide promising results that individuals are surviving.

DESIGNATED CRITICAL HABITAT FOR LISTED COLORADO RIVER FISHES

HABITAT DESCRIPTION

In the Upper Colorado River Basin, portions of the White, Yampa, Gunnison, Green, Colorado, and San Juan Rivers and their 100-year floodplain are designated as critical habitat for one or more of the federally listed species described above. Critical habitat is defined as specific geographic areas, whether occupied by a listed species or not, that are essential for its conservation and that are formally designated by rule. In the State of Utah, immediately downstream of Wyoming, many of these critical habitat reaches overlap. Critical habitat for the humpback chub and bonytail are primarily canyon-bound reaches, while critical habitat for the

Colorado pikeminnow and razorback sucker include long stretches of river required for migration corridors and larval fish drift.

Concurrently with designating critical habitat, the Service identified primary constituent elements (PCEs) of the habitat. PCEs are physical or biological features essential to the conservation of a species for which its designated or proposed critical habitat is based on, such as: space for individual and population growth, and for normal behavior; food, water, air, light, minerals, or other nutritional or physiological requirements; cover or shelter; sites for breeding, reproduction, rearing of offspring, germination, or seed dispersal; and habitats that are protected from disturbance or are representative of the species historic geographic and ecological distribution.

The Service has identified water, physical habitat, and the biological environment as the primary constituent elements of critical habitat for listed Colorado River fish species (59 FR 13374). Water includes a quantity of water of sufficient quality delivered to a specific location in accordance with a hydrologic regime required for the particular life stage for each species. The physical habitat includes areas of the Colorado River system that are inhabited or potentially habitable for use in spawning and feeding, as a nursery, or serve as corridors between these areas. In addition, oxbows, backwaters, and other areas in the 100-year floodplain, when inundated, provide access to spawning, nursery, feeding, and rearing habitats. Food supply, predation, and competition are important elements of the biological environment.

HABITAT USAGE

The four listed fish species are adapted to a hydrologic cycle characterized by large spring peaks of snowmelt runoff and low, relatively stable base flows (U.S. Fish and Wildlife Service 2002b). High spring flows maintain channel and habitat diversity, flush sediments from spawning areas, rejuvenate food production, form gravel and cobble deposits used for spawning, and rejuvenate backwater nursery habitats (U.S. Fish and Wildlife Service 2002b).

Throughout most of the year, juvenile, subadult, and adult Colorado pikeminnow use relatively deep, low-velocity eddies, pools, and runs that occur in near-shore areas of main river channels (multiple references in U.S. Fish and Wildlife Service 2002b). Adults require pools, deep runs, and eddy habitats maintained by high spring flows. In spring, however, adults use floodplain habitats, flooded tributary mouths, flooded side canyons, and eddies that are available only during high flows (multiple references in U.S. Fish and Wildlife Service 2002b). Newly hatched larval fish drift downstream to backwaters in sandy, alluvial regions, where they remain through most of their first year of life (multiple references in U.S. Fish and Wildlife Service 2002b). Because of their mobility and environmental tolerances, adult Colorado pikeminnow are more widely distributed than other life stages.

Similar to Colorado pikeminnow, razorback sucker use a variety of habitats throughout their life cycle. Outside of the spawning season, adult razorback suckers occupy a variety of shoreline and main channel habitats including slow runs, shallow to deep pools, backwaters, eddies, and other relatively slow velocity areas associated with sand substrates (U.S. Fish and Wildlife Service 2002d). In spring and winter adult razorback sucker require deeper, low-velocity habitat, but are known to occupy shallow sandbars in summer (McAda and Wydoski 1980 in Zelasko et al. 2009). Reproductive activities are believed to take place in off-channel habitats and tributaries because razorback sucker aggregations were reported in these areas. Off-channel habitats are much warmer than the mainstem river and razorback suckers presumably move to these areas for spawning and other activities, such as, feeding, resting, or sexual maturation.

Off channel and floodplain habitat is also important to young razorback sucker. After hatching, razorback sucker larvae drift downstream to low-velocity floodplain or backwater nursery habitat. The absence of seasonally flooded riverine habitats is believed to be a limiting factor in the successful recruitment of razorback suckers in their native environment. Starvation of larval razorback suckers due to low zooplankton densities in the main channel and loss of floodplain habitats which provide adequate zooplankton densities for larvae food is one of the most important factors limiting recruitment.

Unlike Colorado pikeminnow and razorback sucker, humpback chub show high site fidelity for canyon-bound reaches of mainstem rivers. Past captures of adults were associated with large boulders and steep cliffs. Reproductive habitat is not defined because although humpback chub are believed to broadcast eggs over mid-channel cobble and gravel bars, spawning in the wild has not been observed for this species. It is believed that upon emergence from spawning gravels, humpback chub larvae remain in the vicinity of bottom surfaces near spawning areas. As larval fish mature, backwaters, eddies, and runs were reported as common capture locations for young-of-year humpback chub.

While bonytail are closely related to humpback chub, their habitat usage may be slightly different. Bonytail are observed in pools and eddies in mainstem rivers, but recent information collected by the Recovery Program suggests that floodplain habitats may be more important to the survival and recovery of the bonytail than originally thought. Although spawning events in river habitat has not been documented, bonytail probably spawn in rivers over rocky substrates because spawning is observed in reservoirs over rocky shoals and shorelines. Recent hypotheses surmise that flooded bottomlands may provide important bonytail nursery habitat.

ENVIRONMENTAL BASELINE

Regulations implementing the ESA (50 CFR 402.02) define the environmental baseline as the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed State or Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation process..

STATUS OF THE SPECIES IN THE ACTION AREA

While the Project occurs in Wyoming, depletions associated with the Project from Little Snake River, a tributary to the Green and Colorado Rivers, adversely affect all four endangered fish species within the Upper Colorado River Basin Recovery Unit. The use of water from the Upper Colorado River Basin affects the habitat quantity and quality downstream of the Project location, for many miles.

Within this Recovery Unit, specific recovery criteria are established for the Green River sub-basin for all four species, including population demographics. Self-sustaining and stable populations of these species in the Green River sub basin are required for full species recovery (U.S. Fish and Wildlife Service 2002a, 2002b, 2002c, 2002d). The entire length of the Green River and its 100 year floodplain are designated as critical habitat for at least one species between the Yampa River confluence and the Colorado River confluence (Federal Register: 59 FR 13374).

The largest, most productive and most robust population of Colorado pikeminnow occurs in the mainstem Green River (combining the lower Green River, Desolation/Gray Canyon, and middle Green River populations). Higher abundance of Colorado pikeminnow juveniles and recruits in the 2006 to 2008 sampling period is attributed to a relatively strong year class of age-0 Colorado pikeminnow produced in the lower Green River in 2000 (Bestgen et al. 2010). Length frequency histograms, especially in the Desolation-Gray Canyon and lower Green River reaches, indicate that abundance of Colorado pikeminnow recruits was much higher in period 2006 to 2008 than from 2000 to 2003 (Bestgen et al. 2010). The importance of Green River populations is also evident because increased abundance of adult Colorado pikeminnow in the White River and middle Green River through 2008 almost certainly derived from upstream movement (high transition rates) of large numbers of juvenile and recruit-sized Colorado pikeminnow that originated in downstream reaches of the Green River in 2006 and 2007 (Bestgen et al. 2010). Colorado pikeminnow spawn in two principal sites: Gray Canyon in the lower Green River, and the lower Yampa River (U.S. Fish and Wildlife Service 2002b).

The action area includes the largest concentration of razorback suckers in the Upper Colorado River Basin, found in low-gradient flat-water reaches of the middle Green River between and including the lower few miles of the Duchesne River and the Yampa River. Known spawning sites for razorback sucker are located in the lower Yampa River and in the Green River near Escalante Ranch, but other, less-used sites are probable, such as Desolation Canyon (U.S. Fish and Wildlife Service 2002d). Both Colorado pikeminnow and razorback sucker are migratory spawners, whose young emerge as larval fish from spawning locations and drift downstream. Because Colorado pikeminnow and razorback sucker spawning locations occur downstream of the Project, all life stages are present within the action area.

Humpback chub occur in Westwater Canyon, Desolation/Gray Canyons and Cataract Canyon, but not in other river reaches in the action area. Preliminary population estimates in 2002 approximate 2,000 to 5,000 humpback chub in Westwater Canyon, 1,500 in Desolation/Gray Canyons, and 500 in Cataract Canyon (USFWS 2002c).

Bonytail are so rare that it is currently not possible to conduct population estimates. However, the action area includes the middle Green River, which is part of the current stocking program area (along with the Yampa River in Dinosaur National Monument).

STATUS OF CRITICAL HABITAT IN THE ACTION AREA

The action area includes critical habitat units, which are identified as essential for the species' recovery (U.S. Fish and Wildlife Service 2002a, 2002b, 2002c, 2002d). While historical water depletions do not occur within all critical habitat units, historical changes in Green River and

Colorado River water volume have nonetheless affected critical habitat by changing the amount of water flowing into these designated habitat units. The action area includes critical habitat units on the mainstem Green River and Colorado River below the Green River confluence.

As previously described, all four of the listed Colorado River fish require the same Primary Constituent Elements (PCEs) essential for their survival. Water, physical habitat, and the biological environment are the PCEs of critical habitat. This includes a quantity of water of sufficient quality that is delivered to a specific location in accordance with a hydrologic regime that is required for the particular life stage for each species. The physical habitat includes areas of the Colorado River system that are inhabited or potentially habitable for use in spawning and feeding, as a nursery, or serve as corridors between these areas. In addition, oxbows, backwaters, and other areas in the 100-year floodplain, when inundated, provide access to spawning, nursery, feeding, and rearing habitats. Food supply, predation, and competition are important elements of the biological environment.

Historically, the Green River produced high spring turbid flows that maintained critical habitat by inundating floodplains, maintaining side channels, flushing fine sediment, and creating backwaters (Muth et al. 2000). However, with the completion of Flaming Gorge Dam in 1962, the mainstem Green River became highly regulated. The dam and reservoir physically altered the Green River and surrounding terrain and modified the pattern of flows downstream (Muth et al. 2000). Most notably, the construction of the dam created a fish passage barrier and transformed miles of riverine habitat into lacustrine habitat. These two changes isolated fish populations and decreased the amount of native habitat.

Operation of the dam also results in effects to native fish communities. Historically, water releases from Flaming Gorge Dam did not mimic natural flow patterns and introduced colder water into the river from the deep pool behind the dam (Muth et al. 2000). Alteration of the natural flow regime affects stream vegetation communities and channel morphology, which modify native fish habitat (Muth et al. 2000). Natural flow regimes may act as cues for important life history events, like spawning. Life history events are similarly affected by water temperature, with colder temperatures disrupting the temporal spawning regime of native fish.

Additionally, Flaming Gorge Dam created new water resource impacts, such as irrigation potential, municipal use, and recreational fisheries of introduced non-native species. Water storage provided by the dam allowed local communities to increase water usage for agriculture and municipal purposes. Increased water depletion from the Green River decreases native fish habitat and limits the amount of backwater nursery habitat for juvenile fish. Also, increased water supply for agriculture and municipal purposes increases the likelihood of degraded water quality from agricultural runoff (pesticides, fertilizers, etc.) and wastewater inputs.

All four federally listed species evolved in desert river hydrology, relying on high spring flows and stable base flows for habitat conditions essential to their survival (see Status of the Species and Critical Habitat). In addition to main channel migration corridors, Colorado pikeminnow, bonytail and razorback sucker rely on floodplain and backwater habitats for various stages of their life history. High spring flows also act as spawning queues. In contrast, humpback chub rely more on canyon-bound reaches with swift currents and white water.

Currently, two primary reaches of Colorado pikeminnow nursery habitat are present in the Green River system. The lower reach occurs from near Green River, Utah, downstream to the Colorado River confluence. The upper reach occurs from near Jensen, Utah, downstream to the Duchesne River confluence. Larvae from Desolation Canyon colonize flooded backwater areas in the lower Green River area. These backwaters are especially important during the Colorado pikeminnow's critical first year of life. The Project is located upstream of both nursery habitat reaches and floodplain habitat.

Bottomlands, low-lying wetlands, and oxbow channels flooded and ephemerally connected to the main channel by high spring flows appear to be important habitats for all life stages of razorback sucker. These areas provide warm water temperatures, low-velocity flows, and increased food availability.

Humpback chub occur in Desolation/Gray Canyons, and within the action area. Adults require eddies and sheltered shoreline habitats maintained by high spring flows. These high spring flows maintain channel and habitat diversity, flush sediments from spawning areas, rejuvenate food production, and form gravel and cobble deposits used for spawning. Flow recommendations were developed that specifically consider flow-habitat relationships in habitats occupied by humpback chub in the upper basin, and were designed to enhance habitat complexity and to restore and maintain ecological processes.

PRIMARY CONSTITUENT ELEMENT – WATER - The quality and quantity of water in the action area of the Green River has decreased from water projects, most notably Flaming Gorge Dam and the Central Utah Project. A number of tributaries to the Green River appear on the State of Utah's 303(d) list of impaired streams for various reasons (Utah Division of Water Quality 2004). Tributaries and sections of the Price, San Rafael, and Duchesne Rivers are listed for elevated salinity, TDS, and chlorides, as are portions of Ashley and Pariette Draw Creeks. Brush, Pariette Draw, and Lower Ashley Creeks are listed for elevated selenium. Willow and Indian Canyon Creeks are listed for elevated total dissolved solids. Ninemile Creek is listed for elevated temperature. Lake Fork Creek is listed for elevated sediments. Lastly, Pariette Draw Creek is listed for elevated boron. These elevated pollutants pose a risk to this PCE. As these tributares reach the main stem, these pollutants are introduced to the Green River as well. Currently the Green River acts as a dilution for these pollutants, as is evident by the Green River not appearing on the State of Utah's impaired water list. However, these pollutants still occur in the river and as new water depletions occur, these pollutants will be found in higher concentrations.

Large water diversion projects, large-scale agricultural water use, and climate change have all altered the water quantity in the Green River over the past 150 years. Most notably, Flaming Gorge Dam has altered the magnitude and timing of flows in endangered fish habitat. Peak spring flows in the Green River at Jensen, Utah, have decreased 13 to 35 percent and base flows have increased 10 to 140 percent due to regulation by Flaming Gorge Dam (Muth et al. 2000). However, since 2006 changes were made in the operation of Flaming Gorge Dam that provide flow and meet temperature requirements for native fish. The next major step in providing adequate habitat for the endangered fish is determining how to protect flows to consistently meet demands and endangered fish flow recommendations (see Flow Protection in the Green River, below). As part of this effort, researchers have created hydrologic models to determine how often the flow recommendations would be met using current operations and past water supplies.

PRIMARY CONSTITUENT ELEMENT – PHYSICAL HABITAT- The completion of Flaming Gorge Dam created a fish passage barrier. Native Colorado pikeminnow, razorback sucker, humpback chub, and bonytail can no longer migrate into Wyoming from the lower Green River. Fish barriers isolate populations, decreasing the ability of individuals to interact, and hinder the transfer of genetic material. The quantity and timing of flows influence how the channel and various habitats are formed and maintained. Channel narrowing is a problem because as the channel width decreases, water velocity increases, and the amount of low velocity habitats, important to the early life stages of the fish, decreases. Habitat below Flaming Gorge Dam has historically been shaped by an artificial flow regime which decreased low flow habitats, disrupted vegetative communities, and altered channel morphology. However, recent operation changes have made this flow regime match more natural conditions. These changes affect temperature, channel morphology, and habitat conditions.

PRIMARY CONSTITUENT ELEMENT – BIOLOGICAL ENVIRONMENT- This PCE is impaired by the presence of non-native fishes common in the Green River. Non-native fishes occupy the same backwaters that are very important for young Colorado pikeminnow and razorback sucker. Specifically, largemouth (*Micropterus salmoides*) and smallmouth bass (*Micropterus dolomieu*), walleye (*Sander vitreus*), northern pike (*Esox lucius*), and channel catish (*Ictalurus punctatus*) are present in this system and predate upon juvenile native fish. Programs are ongoing to remove bass, walleye and northern pike from this system. Other non-natives found in the Green River include centrarchids and non-native cyprinids. Reduction in flows contributes to further habitat alterations that support nonnative fish species, such as increased temperatures, reduced habitat availability, and reduced turbidity.

FACTORS AFFECTING THE SPECIES ENVIRONMENT IN THE ACTION AREA

This baseline includes State, tribal, local, and private actions already affecting the species or that will occur contemporaneously with the consultation in progress. Unrelated Federal actions affecting the same species or informal consultation are also part of the environmental baseline, as are Federal and other actions within the action area that may benefit listed species or critical habitat.

UPPER COLORADO RIVER ENDANGERED FISH RECOVERY PROGRAM - The Upper Colorado River Endangered Fish Recovery Program was established in 1988 to help recover the four endangered fish species (see Consultation History). The Recovery Program implements management actions within seven Program elements, as dictated from species' recovery goals, with the focus of down-listing and de-listing the species. Five of these actions impact the species in the action area: instream flow identification and protection; habitat restoration; non-native fish management; propagation and stocking; and research and monitoring.

Current management actions performed by the Recovery Program in the Project action area include, but are not limited to:

- Overseeing non-native fish removal activities in the Green River Basin, downstream of the Project. Nonnative fishes of immediate primary concern and currently explicitly targeted for management are northern pike, smallmouth bass, walleye, and burbot (*Lota lota*). These nonnative fish species pose significant threats to the endangered fishes because of their high or increasing abundance and range expansion, their habitat and resource requirements overlap with those of the endangered fish species, and their predatory impact;

- Participating in the Flaming Gorge Technical Workgroup, which manages releases from Flaming Gorge Dam to benefit endangered fish species while meeting other legal purposes of the dam. This technical team establishes base flow and spring peak release criteria from Flaming Gorge that meet the Flow Recommendations (Muth et al. 2000); and
- Stocking of bonytail and razorback sucker into the middle and lower Green River.

FLOW PROTECTION IN THE GREEN RIVER - Recovery cannot be accomplished without securing, protecting, and managing sufficient habitat to support self-sustaining populations of the endangered fishes. Identification and protection of instream flows are key elements in this process. The first step in this process, identifying instream flows needed for recovery, was completed for the action area with the publication of the Flow Recommendations (Muth et al. 2000). However, there is no legal protection of flows in the Utah portion of the Green River. The process for meeting this recovery goal is ongoing, as described below.

Several approaches may be taken under Utah water law to protect instream flows, including: 1) acquiring existing water rights and filing change applications to provide for instream flow purposes; 2) withdrawing unappropriated waters by governor's proclamation; 3) approving presently filed and future applications subject to minimum flow levels; and 4) with proper compensation, preparing and executing contracts and subordinating diversions associated with approved and perfected rights.

Although Utah water law may not fully provide for all aspects of instream-flow protection, the State believes they can provide an adequate level of protection. Utah examined available flow protection approaches in the 1990's and determined that their primary strategy will be to condition the approval of presently filed and new applications, making them subject to predetermined streamflow levels. To accomplish this, the State Engineer adds a condition of approval to post-1994 water right applications above Jensen filed after the policy is adopted. The condition states that whenever the flow of the Green River (or other streams) drops below the predetermined streamflow level, then diversions associated with water rights approved after the condition is imposed are prohibited. Based on past legal challenges to the State's authority to impose conditions associated with new approvals, it was determined that this is within the authority of the State Engineer.

This approach does not specifically recognize an instream-flow right; however, it does protect the flows from being diverted and used by subsequently approved water rights. This approach was adopted as policy by the State Engineer. The policy requires that presently filed and new applications to be approved are subject to the summer and fall flow recommendations. As flow recommendations are finalized and accepted, Utah will review options for protecting the recommended flows. In 2009, Utah determined that the aforementioned "subordination" method of flow protection may not be feasible below Jensen. The Recovery Program's Water Acquisition Committee formed a task force to develop other options for protecting fish flows on the Green River. In 2010, modeling began (and is ongoing) to determine the volume of water that would be needed to protect fish flow targets under current demands and projected future demands. Preliminary results of modeling indicate that under current and future demands the lowest flow years may not meet the flow recommendation targets in Reach 3 without additional protected volumes of water. The volume of water needed and flow protection are planned to be determined by 2017.

PARTICIPATION IN THE FLAMING GORGE TECHNICAL WORKGROUP - The Flaming Gorge Technical Working Group (FGTWG) was established pursuant to the Operation of Flaming Gorge Dam Final Environmental Impact Statement (FEIS) as recommended in the Flow and Temperature Recommendations for Endangered Fishes in the Green River Downstream of Flaming Gorge Dam (Flow Recommendations) (Muth et al. 2000). Members of the FGTWG include biologists and hydrologists from the Recovery Program, Bureau of Reclamation (BOR), the U.S. Fish and Wildlife Service, and Western Area Power Administration. The Record of Decision on the FEIS clarified the purpose of the FGTWG as limited to proposing specific flow and temperature targets for each year's operations based on current year hydrologic conditions and the conditions of the endangered fish. The FGTWG was also charged with integrating, to the extent possible, any flow requests from the Upper Colorado River Endangered Fish Recovery Program (Recovery Program) into the flow proposal so that Recovery Program research could also be facilitated. This process concurrently serves the informal consultation and coordination requirements of the ESA for the action agencies as committed to in the ROD.

Flaming Gorge operations greatly impact the hydrologic conditions found in the action area. The BOR sets Flaming Gorge releases to support target flows at the Jensen gauge (Reach 2 from the FEIS), which in turn substantially affect the flows at the Green River, Utah gauge (Reach 3). Recommended base flows in Reach 3 are measured immediately downstream of the Project; therefore adequate base flows in Reach 3 would support all Project features (water use, boat passage, fish passage, etc). However, BOR and the Service recognize that between Flaming Gorge and Green River, Utah, there are many stream miles, inputs and withdrawals, and disparate weather patterns. T herefore, BOR does not manage Flaming Gorge to attempt to meet Reach 3 targets; instead they assume that managing for Reach 2 targets should adequately meet Reach 3 targets. While meeting Reach 2 targets may not always cause Reach 3 targets to be met, water supplied for Reach 2 does support higher base flows in Reach 3. As long as hydrology and climatic patterns supply adequate runoff, continued cooperation between the FGTWG members to release adequate base flows for Reach 2 will support conditions at the Project area.

ENDANGERD FISH STOCKING - Each year tens of thousands of bonytail and razorback sucker are stocked into the main stem Green River. Two primary stocking locations are in the middle Green River near Ouray National Wildlife Refuge and in the lower Green River at Green River State Park. Stocking these fish in the main stem river is designed to supplement the population and eventually create a self-sustaining population.

EFFECTS OF THE ACTION

EFFECTS TO ENDANGERED SPECIES

The Project will adversely affect Colorado pikeminnow, razorback sucker, bonytail, and humpback chub by reducing the amount of water in the river system upon which they depend by up to 650 acre-feet per year. The effects to all four species primarily result from the effects of the action upon their habitats. In general, the proposed action will adversely affect the four listed fish by reducing the amount of water available to them, increasing the likelihood of water quality issues, increasing their vulnerability to predation, and reducing their breeding opportunities by shrinking the amount of breeding and nursery habitat within their range.

Removing 650 acre-feet per year from the Colorado River Basin will alter the natural hydrological regime that creates and maintains important fish habitats, such as spawning habitats, and reduces the frequency and duration of availability of these habitats of the four endangered fish. The reduction of available habitats will directly affect individuals of all four species by decreasing reproductive potential and foraging and sheltering opportunities. Many of the habitats required for breeding become diminished when flows are reduced. As a result, individual fish within the action area may not find suitable breeding locations or will deposit eggs in less than optimal habitats more prone to failure or predation. In addition, reduction in flow rates lessens the ability of the river to inundate bottomland, a source of nutrient supply for fish productivity. Water depletions also exacerbate competition and predation by nonnative fishes by altering flow and temperature regimes toward conditions that favor non-natives.

The proposed depletions affect the water quality in the action area by increasing concentrations of heavy metals, selenium, salts, pesticides, and other contaminants. Increases in water depletions will cause associated reductions in assimilative capacity and dilution potential for any contaminants that enter the river. The Project depletions will cause a proportionate decrease in dilution, resulting in an increase in heavy metal, selenium, salts, pesticides, and other contaminant concentrations in the Colorado River system. An increase in contaminant concentrations in the river can result in an increase in the bioaccumulation of these contaminants in the food chain which could adversely affect the endangered fishes. Selenium is of particular concern due to its effects on fish reproduction and its tendency to concentrate in low velocity areas that are important habitats for Colorado pikeminnow and razorback sucker.

The proposed Project will affect the physical condition of habitat for the four listed fish by resulting in a reduction of water. This reduction will contribute to the cumulative reduction in high spring flows, which are essential for creating and maintaining complex channel geomorphology and suitable spawning substrates, creating and providing access to off-channel habitats, and possibly stimulating Colorado pikeminnow spawning migrations. Adequate summer and winter flows are important for providing a sufficient quantity of preferred habitats at a duration and frequency necessary to support all life stages of viable populations of all endangered fishes. To the extent that the proposed Project will reduce flows, the ability of the river to provide these functions will be reduced. This reduction of water affects habitat availability and habitat quality.

To the extent that it will reduce flows and contribute to further habitat alteration, the proposed project may contribute to an increase in nonnative fish populations. The modification of flow regimes, water temperatures, sediment levels, and other habitat conditions caused by water depletions has contributed to the establishment of nonnative fishes. Endangered fishes within the action area will experience increased competition and predation as a result.

EFFECTS TO CRITICAL HABITAT

All four of the listed Colorado River fish require the same primary constituent elements (PCEs) essential for their survival. Therefore, we are combining our analysis of all four species into one section. Because the amount of designated critical habitat varies for each of the four species, the amount of critical habitat will vary; however, the effects will be the same for all critical habitats within the action area.

Water, physical habitat, and the biological environment are the PCEs of critical habitat. This includes a quantity of water of sufficient quality that is delivered to a specific location in accordance with a hydrologic regime that is required for the particular life stage for each species. The physical habitat includes areas of the Colorado River system that are inhabited or potentially habitable for use in spawning and feeding, as a nursery, or serve as corridors between these areas. In addition, oxbows, backwaters, and other areas in the 100-year floodplain, when inundated, provide access to spawning, nursery, feeding, and rearing habitats. Food supply, predation, and competition are important elements of the biological environment.

Primary Constituent Element – Water

he subject action would deplete up to 650 acre-feet per year from the Colorado River Basin. Removing water from the river system changes the natural hydrological regime that creates and maintains important fish habitats, such as spawning habitats, and reduces the frequency and duration of availability of these habitats of the four endangered fish. In addition, reduction in flow rates lessens the ability of the river to inundate bottomland, a source of nutrient supply for fish productivity and important nursery habitat for razorback sucker. Water depletions change flow and temperature regimes toward conditions that favor nonnative fish, thus adding to pressures of competition and predation by these nonnative fishes as discussed above.

Changes in water quantity would affect water quality, which is a PCE of critical habitat. Contaminants enter the Colorado River from various point and non-point sources, resulting in increased concentrations of heavy metals, selenium, salts, pesticides, and other contaminants. Increases in water depletions will cause associated reductions in assimilative capacity and dilution potential for any contaminants that enter critical habitat in the Colorado River. The subject depletions will cause a proportionate decrease in dilution, which in turn would cause a proportionate increase in heavy metal, selenium, salts, pesticides, and other contaminant concentrations in the Upper Colorado River Basin, affecting water quality.

Primary Constituent Element - Physical Habitat

The subject action will affect the physical condition of habitat for the four listed fish by resulting in a reduction of water. This reduction will contribute to the cumulative reduction in high spring flows, which are essential for creating and maintaining complex channel geomorphology and suitable spawning substrates, creating and providing access to off-channel habitats, and possibly stimulating Colorado pikeminnow spawning migrations. Adequate summer and winter flows are important for providing a sufficient quantity of preferred habitats for a duration and at a frequency necessary to support all life stages of viable populations of all endangered fishes. To the extent that the subject action will reduce flows, the ability of the river to provide these functions will be reduced. This reduction of water affects habitat availability and habitat quality.

Primary Constituent Element - Biological Environment

To the extent that it will reduce flows and contribute to further habitat alteration, the Project may contribute to an increase in nonnative fish populations. The modification of flow regimes, water temperatures, sediment levels, and other habitat conditions caused by water depletions has contributed to the establishment of nonnative fishes. Endangered fishes within the action area would experience increased competition and predation as a result.

CUMMULATIVE EFFECTS

Cumulative effects include the effects of future State, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA. In Wyoming, most water depletions within the Colorado River Basin include a Federal nexus and will be addressed in future section 7 consultations.

CONCLUSION

After reviewing the current status of the Colorado pikeminnow, humpback chub, bonytail, and razorback sucker, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's biological opinion that the Project, as described in this biological opinion, is not likely to jeopardize the continued existence of endangered fish and is not likely to destroy or adversely modify designated critical habitat.

INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and Federal regulation pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the USFWS to include significant habitat modification or degradation that results in death or injury of listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass means an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

Colorado pikeminnow, humpback chub, bonytail, and razorback sucker are harmed from the reduction of water in their habitats resulting from the subject action in the following manner: (1) individuals using habitats diminished by the proposed water depletions could be more susceptible to predation and competition from non-native fish, and (2) habitat conditions may be rendered unsuitable for breeding because reduced flows would impact habitat formulation and maintenance as described in the biological opinion.

Estimating the number of individuals of these species that would be taken as a result of water depletions is difficult to quantify for the following reasons: (1) determining whether an individual forwent breeding as a result of water depletions versus natural causes would be extremely difficult to determine; (2) finding a dead or injured listed fish would be difficult, due to the large size of the action area and because carcasses are subject to scavenging; (3) natural fluctuations in river flows and species abundance may mask depletion effects, and (4) effects that reduce fecundity are difficult to quantify. However, we believe the level of take of these species can be monitored by tracking the level of water reduction and adherence to the Recovery Program. Specifically, if the Recovery Program (and relevant RIPRAP measures) is not implemented, or if the current anticipated level of water depletion is exceeded, we fully expect the level of incidental take to increase as well. Therefore, we exempt all take in the form of harm that would occur from the removal of 650 acre-feet of water per year. Water depletions above the amount addressed in this biological opinion would exceed the anticipated level of incidental take and are not exempt from the prohibitions of section 9 of the Act.

The implementation of the Recovery Program is intended to minimize impacts of water depletions; therefore, support of Recovery Program activities by the BLM as described in the proposed action exempts the BLM and project proponent from the prohibitions of section 9 of the ESA. The BLM is responsible for reporting to the Service if the amount of average annual depletion is exceeded.

REASONABLE AND PRUDENT MEASURES

In addition to the conservation measures identified earlier in this document, we believe the following reasonable and prudent measures are necessary and appropriate to minimize the impacts of incidental take of Colorado pikeminnow, humpback chub, bonytail, and razorback sucker.

1. The BLM and Project proponents must implement a monitoring and reporting program to ensure that the annual depletion does not exceed 650 acre-feet and that the cumulative depletion for the Project does not exceed 9,750 acre-feet (i.e., 650 acre-feet for 15 years of development).

TERMS AND CONDITIONS

In order to be exempt from the prohibitions of section 9 of the ESA, the BLM and Project proponent must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are nondiscretionary.

In order to implement a monitoring and reporting program:

1. The BLM and Project proponent will identify those wells pulling water from the Wasatch Formation within that portion of the Washakie Structural Basin that loses groundwater to the southeast toward the Little Snake River, a tributary of the Colorado River.
2. The Project proponent will regularly (e.g., quarterly) provide a written report of water withdrawn from the wells identified above.
3. The BLM will track annual and cumulative depletions and will work with the Project proponent to identify alternate water sources if depletions approach the amounts identified above in the reasonable and prudent measures.

REINITIATION NOTICE

This concludes formal consultation on the action outlined in the request. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded, (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion, (3) the action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion, or (4) a new species is listed or critical habitat designated that may be affected by the action.

We appreciate your efforts to ensure the conservation of endangered, threatened, and candidate species and migratory birds. If you have questions regarding this letter or your responsibilities under the Act, please contact Nathan Darnall of my office at the letterhead address or phone (307) 772-2374, extension 246.

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